DOCUMENT RESUME

ED 253 715 CE 040 704

AUTHOR	Gregory, Margaret R.; Benson, Robert T.
TITLE	V-TECS Guide for Auto Body Repair.
INSTITUTION	South Carolina State Dept. of Education, Columbia. Office of Vocational Education.
PUB DATE	84
NOTE	178p.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC08 Plus Postage.
DESCRIPTORS	Administrators; *Auto Body Repairers; Behavioral Objectives; Classroom Techniques; *Cost Estimates; Equipment Utilization; Hand Tools; Learning Activities; Managerial Occupations; *Metal Working; *Painting (Industrial Arts); Safety; Secondary Education; State Curriculum Guides; Student Evaluation; Teaching Methods; *Vocational Education; *Welding
IDENTIFIERS	*Automobiles

ABSTRACT

This curriculum guide consists of materials for teaching a course in auto body repair. Addressed in the individual units of the guide are the following topics: the nature and scope of auto body repair; safety; tools; auto body construction; simple metal straightening; welding; painting and refinishing; refinishing complete lacquer; refinishing complete enamel; detailing; body and frame alignment; welding frames and frame horns; repairing, replacing, adjusting, and installing trim and accessories; removing and installing glass; making cost estimates; and performing managerial duties and writing work orders. Each unit contains some or all of the following: series of duty and task lists, performance objectives, learning activities, lists of suggested resources, lists of tools and equipment to complete each individual task covered in the unit, and evaluation criteria. Appendixes to the guide contain a duty and task list, a series of definitions, a tool and equipment list, and a bibliography. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

V-TECS GUIDE
FOR
AUTO BODY REPAIR

Prepared By

Margaret R. Gregory
Project Coordinator

Robert T. Benson, Ed. D.
Technical Coordinator

SOUTH CAROLINA DEPARTMENT OF EDUCATION
Dr. Charlie G. Williams, State Superintendent of Education

Division of Instruction
Sidney B. Cooper, Deputy Superintendent

Office of Vocational Education
Dr. Moody M. Oswald, Jr., Director

South Carolina Department of Education: An Equal Opportunity Agency
Columbia, South Carolina 29201

Copyright 1984

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)
☑ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY
L Knight
TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

ACKNOWLEDGMENTS

This V-TECS Guide was developed with the help of auto body repair teachers who are involved in the teaching of Auto Body Repair as part of their curricula. The following committee members and South Carolina State Office staff made outstanding contributions to this Guide.

Charles G. Moore, State Supervisor
Trade and Industrial Education
South Carolina Department of Education

Joseph E. Bunn, Consultant
Trade and Industrial Education
South Carolina Department of Education

Dr. Annie S. Winstead, Consultant
Sex Equity
South Carolina Department of Education

Waycaster Alexander
Fairfield County Vocational Center
Winnsboro, South Carolina

Robert Cook
Richland Northeast High School
Columbia, South Carolina

Monroe Friday
Sumter Career Center
Sumter, South Carolina

Timothy Horton
Kershaw County Area Vocational Center
Camden, South Carolina

Patricia E. Kinsey, Editor
Office of Vocational Education

Jim Lewallen, Word Processing Operator
Office of Vocational Education

Mark Lybrand, Graphic Arts Student
Lexington I Area Vocational Center

TABLE OF CONTENTS

Acknowledgments ii

Field Review iv

Introduction 1

Use of a V-TECS Guide 3

Course Outline

I. Introduction to Auto Body Repair 5
II. Safety 9
III. Tools 21
IV. Auto Body Construction 26
V. Metal Straightening, Simple 34
VI. Welding 47
VII. Painting and Refinishing 86
VIII. Refinishing Complete Enamel 101
IX. Refinishing Complete Lacquer 107
X. Detailing 112
XI. Body and Frame Alignment 117
XII. Welding: Frames and Frame Horns 138
XIII. Repair, Replace, Adjust, and Install Trim and Accessories 141
XIV. Removing and Installing Glass 155
XV. Cost Estimating 164
XVI. Related Instruction 167

Appendices

Appendix A. Duty and Task List 173
Appendix B. Definition of Terms 175
Appendix C. Tool and Equipment List 177
Appendix D. Bibliography 181

FIELD REVIEW

The field review of the **Auto Body Repair Curriculum Guide** was conducted in the winter of 1983. The teachers involved were Mickey Bryant (Darlington Career Center), Ed Fraylick (Brookland - Cayce High School), Kenneth Burrell (H.B. Swofford Area Vocational Center), and David Teague (Lynnhaven Career Center).

Copies of the Guide were inserviced with the committee members. Each member was asked to make comments or corrections in the Guide and then to complete a questionnaire. Overall, the responses were positive with little changes. The review committee was very appreciative of the work that had been done on the Guide and indicated their desire to use it in the classroom. There were two general areas which did seem to bother the reviewers. One area was the definitions and terminology incorporated in the lessons. The writer and the curriculum committee used only standard auto body terms and terms relevant to educators. Consequently no changes seemed necessary. The other area of concern was the introduction of frame straightening. While some small shops do not attempt this type of work, the student should at least have knowledge of the procedure. Several vocational centers in South Carolina teach frame straightening. The teacher has the option of eliminating that section if the equipment and tools are not available. Not all sections are required for the student to complete the courses in Auto Body Repair. However, if all sections are at least reviewed, the student will have a well-rounded knowledge of auto body repair work.

An important feature of this Guide is that a new teacher will have some sources of direction and will be consistent with the course content of other teachers throughout the state.

The State Office of Vocational Education appreciates the time and effort the field review team put into critiquing the Guide.

INTRODUCTION

A V-TECS guide is an extension or continuation of a V-TECS catalog. While the V-TECS catalog compiles duties, tasks, performance objectives, and performance guides, it deals only with the psychomotor aspect of an occupation. A V-TECS catalog is a blueprint; an identification of the "hands on" aspect of the job. The catalog does not take into consideration such areas as the background information surrounding a task and how to make inferences, generalizations, and decisions from a body of knowledge, nor does it deal with attitudes, job seeking skills, safety, or energy conservation practices. It is the function of the V-TECS guide to take these aspects of teaching and learning into consideration.

Experience has shown that the art of learning can also be taught while teaching subject matter. People need to learn how to learn. The V-TECS guide is aware of how students learn and is an efficient way for instructors to assist students to learn.

The V-TECS guide is centered around all three domains of learning: psychomotor, cognitive, and affective. The following paragraphs will give a brief explanation of each area.

Psychomotor

Manipulative skills such as tightening a nut, replacing a hubcap, sharpening a pencil, machining a key slot in a steel shaft, or replacing a SCR in a solid state control panel are examples of manipulative or psychomotor skills. Tasks such as these are identified in a V-TECS catalog and grouped by duties and objectives. Each performance objective has a performance standard which must be met to prove student proficiency in the manipulative aspect of the task. The V-TECS catalog, however, does not include any suggestions with regard to learning to do these tasks. The V-TECS guide is developed around psychomotor tasks which are worker-oriented.

Cognitive

To perform psychomotor tasks, students must think. To tighten a nut they must know which direction to turn and when to stop turning so they won't strip the threads or shear the bolt off. To replace a hubcap, there is a certain technique that may vary from one car to another. For example, on some cars you have to start the hubcap by placing the cap in a tilted position and tapping it all the way around until it is properly seated. On a different model, it may be necessary to position the hubcap and snap it all at once. Whichever method a student is using, he/she must think about what is being done. This involves cognition or mental activity. Cognition is what goes on in the mind about any job being done. A V-TECS guide provides both the collateral knowledge and the impetus to apply cognition to psychomotor tasks.

Students gain cognition through real and vicarious experiences. They may read, view tapes, and memorize or practice a process or procedure until they are certain of it. To test his/her knowledge, a student may be required to decide the proper procedure, method, or sequence for performance. This is decision making or cognitive activity at its highest level.

Cognition, then, is that process by which information is stored and used. That voice that warns one of potential dangers is cognition. Anything that goes on in the mind is cognition. A student may become the best worker at his/her job; but if he/she fails to think a process through and apply any available experience, he/she may become just another statistic. It is cognition that tells a student to lock and tag out the power supply to an electrical apparatus before starting to repair it. Good cognition or thinking can help an employee do a job better and quicker. A V-TECS guide provides for the cognitive aspects of learning.

Affective

Curriculum writers, supervisors, and instructors often fail to assist a student in acquiring a positive attitude toward self, job, school or fellow students. The V-TECS guide seeks to provide assistance to the instructor in this area. It is difficult for the instructor to identify each aspect of desirable behavior for every unit and often harder yet to teach them. In this area, a student might be judged on the housekeeping in the work area, punctuality, and ability to carry out directions. Potential employers are interested in student attitude because an angry or uncertain person is often a poor worker.

A student's ability to succeed on the first job and every job thereafter depends largely on attitude. If a student has the attitude of "let someone else do it," job deficiency will probably result. A student using a V-TECS guide will have participated in activities dealing with getting along with others, with supervisors or staff members, and with large and small groups.

USE OF A V-TECS GUIDE

The V-TECS guide is designed to provide job-relevant tasks, performance objectives, performance guides, resources, learning activities, evaluation standards, and achievement testing in selected occupations. The V-TECS guide is also designed to be used with any teaching methods you, as an instructor, may choose. If the lecture/demonstration method is best for you, you will find sufficient help to meet your needs. If you prefer to use discussions or other methods that require student participation, you will find ample help. Regardless of which method is successful for you, a V-TECS guide can save preparation time and offer innovative methods and procedures. For example, a student may work either alone or on a team while in class and learn skills in direct relation to what is actually being done on the job. This approach also takes into consideration a student's attitudes, thinking skills, and mathematical reading skills.

The use of small groups in teaching can be helpful since many students may feel inadequate due to their lack of background information in mechanical things. Some students may also feel that they are physically incompetent or lack the necessary background experiences. A successful program (course) can provide students with a sense of security by reinforcing positive attitudes while improving their skills and subject knowledge. By allowing students to interact on a personal level, this task/learner-centered approach can achieve this. As students gain confidence and discover that they are an essential part of a team engaged in the learning-teaching process, their confidence increases. The student in this setting will also learn to work without direct supervision. In addition, use of the small-group method permits the instructor to vary instructional routines away from lecture or other full-class methods to activities for single students, pairs of students, or any number so desired.

In the V-TECS guide, you will find suggestions for specific classroom activities. These activities are not meant to restrict you or your students, but only to suggest a variety of learning activities for each task statement. Please do not feel that each student must complete all the activities.

South Carolina Objectives

The South Carolina Writing Team has added 19 tasks to the guide for the purpose of bringing the curriculum up to date with the latest techniques and incorporating instruction in safety. These tasks are aligned with the State-adopted textbooks for South Carolina schools and include introductory or background information in the auto body repair industry. The tasks are designated as SC-1, SC-2, SC-3, etc. in the upper right corner.

The instructor may use the suggested teaching time as a reference point. It is an estimated amount of time for use with average students. The time allotments should in no way limit the instruction directed toward the needs of all students.

The Writing Team also recognizes that instructors will not all follow the same outline for introducing information but will eventually include the same material. This guide is developed in a sequential order with one task building upon the previous one(s). The outline may be altered, however, to allow for accessibility to equipment and difference in student abilities.

One deviation from the V-TECS catalog that the Writing Team found necessary in order to keep the consistency of the outline was to group some objectives under a duty designated differently from the V-TECS catalog and/or to change the wording of the task in order to clarify it. In these instances, the V-TECS catalog duty or task is in parentheses after the Writing Team's duty or task.

SC-1

Suggested instructional time
3 class periods

DUTY: INTRODUCTION TO AUTO BODY REPAIR

TASK: Describe objectives of course in auto body repair

PERFORMANCE OBJECTIVE

Given classroom discussion on objectives of the course and a brief description of the different makes of cars, the student must state the objectives with 90% accuracy.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the objectives of the course.	N/A
II. Tour the shop, and show where equipment, tools, and parts are located.	
III. Show and discuss the film on how a car is designed.	
IV. Distribute diagrams of several makes of cars and discuss the differences in parts and trim.	
V. Discuss and identify the differences between unitized body construction and body and frame construction.	

RESOURCES

"Up from Clay" (film, 45 minutes)

TOOLS AND EQUIPMENT

16 mm projector, screen, tool box with complete set of tools, old practice car

EVALUATION

The student will state the objectives of the course in auto body repair with 90% accuracy.

V-TECS 1

Suggested instructional time
6 class periods

DUTY: INTRODUCTION TO AUTO BODY REPAIR (RELATED INSTRUCTION)

TASK: List occupational elements of auto body repairer

PERFORMANCE OBJECTIVE

Upon completion of the instruction, the student must list the occupational elements (duties, expenses, salaries, etc.) for careers in auto body repair with 90% accuracy.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Show and discuss the film and filmstrip.	
II. List five careers in auto body repair and have students brainstorm for at least five more.	
III. Describe the duties and responsibilities of the auto body repairer.	
IV. Provide a list of the nomenclature for students.	
V. Discuss the salaries and opportunities for advancement.	
VI. Describe the working conditions and surroundings common to auto body repair work.	
VII. Explain the standards of quality for the different occupations.	
VIII. Have each student explain why he/she is taking the course and his/her interest in auto body repair.	
IX. Have body shop owner come to class and talk about his/her shop and the responsibilities involved.	IX. A. Listen to instruction on careers in auto body repair. B. Define the duties and responsibilities of the auto body repairer.

C. Know the nomenclature for auto body repair equipment.
D. Learn about salaries and opportunities in auto body repair.
E. Learn about conditions and surroundings common to auto body repair.
F. Know the standards of quality for occupations in auto body repair.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 3
Body shop owner manual
"Auto Body Repair" (filmstrip)
"The Car Makers" (film)

TOOLS AND EQUIPMENT

Screen, filmstrip projector, 16 mm projector

EVALUATION

The student will list the occupational elements for careers in auto body repair with 90% accuracy.

Suggested instructional time
5 class periods

DUTY: SAFETY (RELATED INSTRUCTION)

TASK: Demonstrate knowledge of first aid and safety

PERFORMANCE OBJECTIVE

After receiving instruction on first aid and safety, the student must pass an examination with 90% proficiency. (South Carolina writing team recommends 100% proficiency.)

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Show and discuss a film on shop safety.	
II. Have students circulate around the shop in teams of four and make a list of potential safety hazards.	
III. Explain the importance of safety in the shop.	III. A. Listen to instruction on first aid and safety. B. Define the terms safety, first aid, and accident. C. List five rules for personal safety. D. Learn shop safety rules. E. Learn methods for maintaining a safe and orderly shop. F. Learn the four classes of fires and the extinguisher for each. G. Learn to identify unsafe shop practices. H. Learn safety color codes and their use. I. Learn first aid measures to control bleeding, restore breathing, treat for poisons, treat for shock, and protect wounds.

J. Learn safe use of auto body repair tools and equipment.

IV. Assign a student per week to monitor the shop for safety violations.

V. Provide for a time during class to discuss the violations.

VI. Explain simple first aid application. Emphasize the fact that any first aid applied in the shop must be reported to the instructor.

VII. Administer sample test and discuss results.

RESOURCES

Sample Safety Test (Student Information Sheet)
"The Art of Safety" (film)
OSHA Rules and Regulations
Duenk, Williams, and Brooks. **Auto Body Repair**, pp. 416-452

TOOLS AND EQUIPMENT

16 mm projector, screen

EVALUATION

The student will complete an examination on safety with 100% accuracy. The results will be filed for future reference.

Student Information Sheet

AUTO BODY — SAFETY TEST*

PART ONE

1. When working in the shop area, protective clothes should be worn when:

_____A. Welding.
_____B. Metal straightening.
_____C. Refinishing a complete vehicle.
_____D. All of the above.

2. What should you do if you have an accident in the shop area?

_____A. Tell your instructor.
_____B. Wash affected area with clean water.
_____C. Ignore it and keep on working.
_____D. Stop work.

3. Why should oil, water, and foreign material be removed from floor?

_____A. To keep from tracking floor.
_____B. To keep shop area looking neat.
_____C. Safety hazard.
_____D. Leave it for someone else to clean up.

4. If you discover a safety hazard in the shop, you should:

_____A. Report it to instructor.
_____B. Correct it.
_____C. Forget it.
_____D. Report it at end of class.

5. What should you do in case of fire?

_____A. Run out of shop.
_____B. Walk out in an orderly manner.
_____C. Try to extinguish the fire.
_____D. Notify the fire department.

6. Where should soiled and oily rags be stored?

_____A. Wooden box.
_____B. Trash can.
_____C. A metal container with a lid.
_____D. Scrap box.

*NOTE: Parts of Safety Test may be used as applicable to study units.

7. Why should playing be eliminated in shop area?

_____A. Safety hazard.
_____B. Causes injuries.
_____C. Loss of eyesight.
_____D. All of above.

8. When not in use, why should all hoses and electrical lines be in their proper place?

_____A. To keep from stepping on them.
_____B. Makes shop and work area look neat.
_____C. Someone might trip over them and cause an injury.
_____D. All of the above.

AUTO BODY — SAFETY TEST

PART TWO

1. How can you check a piece of electrical equipment to make sure it is grounded?

_____A. Check color of cord used on coil.
_____B. Ask the instructor.
_____C. Check to see if it has a three (3) prong plug in.
_____D. None of the above.

2. Why should you never use electrical equipment while standing on a damp surface or with wet hands?

_____A. You might slip and injure yourself.
_____B. You might slip and break the equipment.
_____C. Water is a good conductor of electricity.
_____D. All of the above.

3. The hazard when using a grinder is:

_____A. Chips flying into your eyes.
_____B. Flying grit from disc.
_____C. Loose clothing.
_____D. All of the above.

4. Why should you avoid walking into the plane of sparks and chips when someone else is using the grinder?

_____A. You may trip over the cord connection.
_____B. Sparks and chips may hit you and your eyes.
_____C. You may interfere with the operator.
_____D. All of the above.

5. Why should mushroom heads be removed from chisels and punches?

_____A. So they will look better.
_____B. To protect the hammer face.
_____C. So flying chips won't injure your eyes.
_____D. So you can hit them more accurately.

6. What should you do before using any tools?

_____A. Make sure they are pointed.
_____B. Make sure they are in safe working order.
_____C. Check to see if they will do the job.
_____D. Make sure they are the right size.

7. Why should wrenches always fit the nut or bolt tightly?

_____A. To protect the user.
_____B. To protect the nut or bolt.
_____C. To protect the wrench.
_____D. All of the above.

8. When working with wrenches to tighten or loosen bolts or nuts, you should:

_____A. Push on the wrench.
_____B. Pull on the wrench.
_____C. Use a hammer.
_____D. Use an extension.

9. What are the hazards in using the air chisel?

_____A. Cutting bit flying out of the end of the tool.
_____B. Air hose connection coming loose.
_____C. Chips flying off surface being cut.
_____D. Operator losing control of tool.

10. When using the frame pulling machine, why shouldn't chains be wrapped around sharp corners?

_____A. They will slip when pressure is applied.
_____B. Your measurements will not be true.
_____C. It will cause links to bend, thereby weakening them.
_____D. All of the above.

11. When heating frames to be straightened, why shouldn't you heat the chain?

_____A. It will cause the links to stretch.
_____B. Chains are heat treated for strength; this will weaken them.
_____C. Someone might handle the chain and be burned.
_____D. All of the above.

12. The danger from a broken chain under tension is:

_____A. The vehicle might fail when the chain breaks.
_____B. The chain ends will cause a whip-like action.
_____C. The instructor might make you pay for the chain.
_____D. All of the above.

13. When a vehicle is raised in the air, why should jack stands always be used?

_____A. To give plenty of clearance to work under car.
_____B. So you can remove wheels.
_____C. To insure that the vehicle will not fall if a jack falls.
_____D. In case someone turns release knob on jack.

14. Air under pressure is dangerous:

_____A. If used to blow dust and shavings at anyone.
_____B. If held too close to your skin or any opening in the body.
_____C. When used as a toy to play with.
_____D. All of the above.

15. A pedestal-style grinder should be used:

_____A. For sharpening drill bits.
_____B. For sharpening cutting chisels.
_____C. Only when wearing protective goggles.
_____D. To sharpen knives.

WELDING
AUTO BODY — SAFETY TEST

PART THREE

1. Protective welding goggles are worn when welding:

_____A. To protect your eyes against sparks and heat.
_____B. So you can see the melting taking place.
_____C. Because you look good with them on.
_____D. Because the glare from the torch can cause blindness.

2. Safety caps on all cylinders are:

_____A. Used to make handling tanks easier.
_____B. So you can tell acetylene from oxygen.
_____C. To protect the valve in case the tank is dropped.
_____D. To tie a retaining strap on the cylinder.

3. In storing and using cylinders they should be:

_____A. Laid flat with cap toward wall.
_____B. Laid flat with cap facing outward.
_____C. Always with valve end up and chained to a post or carrier.
_____D. Stood against open wall to be refilled.

4. When lighting the acetylene torch:

_____A. You should use a match.
_____B. Use a cigarette.
_____C. Use a friction lighter.
_____D. Strike torch against metal object.

5. In arc welding you should use:

_____A. Protective goggles as in acetylene welding.
_____B. No goggles because there is less heat.
_____C. Special helmet with shaded glass for arc welding.
_____D. Any type synthetic clothing because it won't burn.

6. Arc welding requires special protection to yourself because:

_____A. It gives off radiation.
_____B. The heavy weight of the equipment used.
_____C. The brilliant light and sparks can cause damage such as a bad sunburn.
_____D. Your eyeballs may be burned, impairing vision.

7. The electrical hazard connected with arc welding comes from:

_____A. High voltage being used.
_____B. Worn or bare leads and connectors.
_____C. Worn out electrode holder.
_____D. All of the above.

REFINISHING
AUTO BODY — SAFETY TEST

PART FOUR

1. Paints and thinners should:

_____A. Be separated for safety.
_____B. Shaken up before using.
_____C. Kept closed to prevent fires and evaporation.
_____D. Not be opened until ready for use.

2. Refinishing should:

_____A. Never be done near an area where welding is taking place.
_____B. Always be done in a well-ventilated shop.
_____C. Be done in a spray booth.
_____D. All of the above.

3. Exhaust fans in spray booths:

_____A. Keep the painter cool.
_____B. Remove moisture from air.
_____C. Draw dust from outside.
_____D. Remove fumes from booth.

4. Respirators are worn by painters:

_____A. To cut down on fire hazards.
_____B. So the painter can smoke as he paints.
_____C. To keep him from inhaling fumes.
_____D. So other students will know who is painting.

5. Fires resulting from paints and thinners:

_____A. May be extinguished with a light spray of water.
_____B. Can be controlled by putting a top on burning cans.
_____C. Throw burning material outside.
_____D. Can only be extinguished with carbon tetrachloride or foam type extinguisher.

6. Due to the highly explosive nature of paints and thinners:

_____A. No sparks of any kind should be in a painting area.
_____B. Smoking is absolutely foridden.
_____C. They should not be dropped.
_____D. They should be stored in a separate, fire-proof building.

7. All work clothes should:

_____A. Have short or neatly rolled sleeves.
_____B. Have shirt tails tucked in.
_____C. Have shirt sleeves buttoned at cuff.
_____D. All of the above.

V-TECS 4

Suggested instructional time
4 class periods

DUTY: TOOLS (RELATED INSTRUCTION)

TASK: Using hand tools*

PERFORMANCE OBJECTIVE

Given instruction on the use of auto body repair hand tools, the student must demonstrate proper use of them according to the instructor's standards.

LEARNING ACTIVITIES

I. Show and discuss the filmstrip on hand tools.

II. Discuss tool design and all basic hand tools and their uses.

III. Discuss and point out safety regarding each tool.

IV. Have students select proper hand tools and demonstrate their use on old body parts.

V. Assign each student to the tool room periodically for the job of issuing tools.

PERFORMANCE GUIDE

IV. A. Listen to and observe instruction on the use of hand tools.
   B. Learn to properly use the following hand tools.
      1. Auto body hammer.
      2. Dollyblock
      3. Measuring tools
      4. Straight line file
      5. Body file
      6. Hacksaws
      7. Other hand tools designated by the instructor.

RESOURCES

"ABC of Hand Tools" (film)
Duenk, Williams, and Brooks. **Auto Body Repair**, pp. 39-60

*Follow safety rules pertaining to hand tools.

TOOLS AND EQUIPMENT

16 mm projector, screen

Ten basic auto body hand tools and any other hand tools used in the trade as designated by the instructor.

Old auto body parts (fender, panels, hoods, etc.)

EVALUATION

The student will demonstrate proper use of hand tools to the instructor's standards.

V-TECS 5

Suggested instructional time
5 class periods

DUTY: TOOLS (RELATED INSTRUCTION)

TASK: Using power tools*

PERFORMANCE OBJECTIVE

Given instruction on power tools, the student must properly use selected power tools according to the instructor's standards.

LEARNING ACTIVITIES

I. Show and discuss the filmstrip on using body jacks and a frame machine.

II. Demonstrate the proper use of power tools.

III. Discuss safety rules on power tools.

IV. Discuss the different kinds of power tools of the trade.

V. Explain and demonstrate the available shop equipment.

VI. Discuss the uses of frame and underbody repair tools.

VII. Have students demonstrate the use of frame gauges and measuring devices on any vehicle in the shop.

PERFORMANCE GUIDE

VII. A. Listen and observe instruction on the proper use of power tools.
B. Identify designated power tools.
C. Identify specified power equipment.
D. Learn the four components of the hydraulic jack.
E. Match specified operations to required power tools.
F. Learn proper use of power tools and equipment.

*Follow safety rules regarding each power tool.

G. Learn to select correct sanding discs, polisher, and buffer pads.

H. Learn safety rules for the following power tools.
   1. Portable power sanders and polisher
   2. Four and ten-ton hydraulic body jacks
   3. Electric and air drills
   4. Pneumatic air hammer
   5. Heat gun
   6. Bench grinder
   7. Drill press
   8. Floor jacks and stands
   9. One end lifts
   10. Frame repair equipment

VIII. Have students practice with body jacks to learn pulling, pushing, spreading, and clamping.

RESOURCES

"Using Body Jacks and Frame Machine" (filmstrip)
Duenk, Williams, and Brooks. **Auto Body Repair**, pp. 61-90

TOOLS AND EQUIPMENT

Filmstrip projector, screen
Frame and underbody equipment, hydraulic body jack, hydraulic floor jacks and any shop equipment used in the trade as designated by instructor.

EVALUATION

The student will properly use selected power tools according to instructor's standards.

Suggested instructional time
6 class periods

DUTY: AUTO BODY CONSTRUCTION (RELATED INSTRUCTION)

TASK: Name the parts of auto body construction

PERFORMANCE OBJECTIVE

Given a diagram of different auto-body parts and construction, the student must name the components with 100% accuracy.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the exterior parts and panels of an auto body.	
II. Discuss the inner parts and panels necessary for auto body construction.	
III. Discuss the exterior trim used on an auto body.	
IV. Discuss the interior trim used on an auto body.	
V. Demonstrate and point out the parts of an auto body using an actual vehicle.	V. A. Listen to the instruction. B. Name and label the following parts. 1. General Parts a) Inner panels b) Outer panels c) Doors and deck lids d) Hoods e) Fenders f) Roof panels g) Floor pans h) Rear quarter panels i) Center body panels j) Rocker panels

2. Exterior Trim
    a) Molding
    b) Ornaments
    c) Locks
    d) Bumpers
    e) Grille
3. Interior Trim
    a) Seats
    b) Door trim
    c) Interior molding

C. Identify difference between unitized and frame body construction.

RESOURCES
Rhone and Yates. **Total Auto Body Repair,** Unit 16

TOOLS AND EQUIPMENT
Vehicle (undamaged)

EVALUATION
The student will name the components on a diagram of different auto body parts and construction with 100% accuracy.

SC-2

Suggested instructional time
6 class periods

DUTY: AUTO BODY CONSTRUCTION

TASK: Identify unitized-body measurement of damaged vehicle

PERFORMANCE OBJECTIVE

Given a damaged vehicle requiring unitized-body inspection which has been set up on a dedicated or universal bench, the student must list the damage and record by each damaged measurement the vehicle's true alignment according to the manufacturer's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the procedure for measuring a damaged vehicle using a dedicated bench with fixtures built to factory specifications.	
II. Discuss the procedure for measuring a damaged vehicle using a universal bench with universal gauging system and body data sheet.	
III. Discuss the procedure for measuring a damaged vehicle using conventional self-centering and tram gauge.	
IV. Explain the importance of correct measurement using instruments and equipment and visually searching for hidden damage.	
V. Describe the different types of equipment used to measure utilized vehicles.	
VI. Demonstrate measuring a damaged vehicle using the above methods.	VI. A. Install vehicle on dedicated or universal bench. B. Read measurements on body data sheet. C. Record all damaged measurements. D. Visually search for hidden damage on dedicated or universal bench.

E. Using self-centering and tram gauges, check all measurements with body data sheet.
F. Check for mash, twist, side sway, and sag.
G. Visually search for hidden damage which does not register on self-centering and term gauge.
H. Record all damaged measurements.

RESOURCES

Blackhawk Company Training Manual
Product Service Training Manual
New Science of Unibody Repair (Complete course with texts, slide/tape, and equipment)

TOOLS AND EQUIPMENT

Damaged unitized vehicle, dedicated or universal bench, frame machine or straightener, self-centering gauges, tram gauge, tape measure, body data sheets, safety goggles

EVALUATION

The student will measure a damaged unitized vehicle using the body data sheet and a dedicated or universal bench. All damage, including hidden damage, must be identified with 100% accuracy.

SC-3

Suggested instructional time
6 class periods

DUTY: AUTO BODY CONSTRUCTION

TASK: Describe frame and unitized construction

PERFORMANCE OBJECTIVE

Given a frame-type vehicle and a unitized-body vehicle, the student must describe the differences between the two types of construction with 100% accuracy.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the characteristics of the frame-type vehicle.	N/A
II. Discuss the characteristics of the unitized-body vehicle.	
III. Provide each type of construction for viewing by the students.	
IV. Have students identify the differences between the frame-type and the unitized-body type of vehicle construction.	
V. Show and discuss the film "Auto Body Construction."	

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Units 15 and 16
"Auto Body Construction" (film and tape)

TOOLS AND EQUIPMENT

16 mm projector, screen
Frame-type vehicle, unitized-body type vehicle, lift or car stand, safety goggles

EVALUATION

The student will describe at least three differences between a frame-type vehicle and a unitized-body type vehicle.

Suggested instructional time
15 class periods

DUTY: AUTO BODY CONSTRUCTION

TASK: Realign a unitized body

PERFORMANCE OBJECTIVE

Given a vehicle with unitized-body damage, the student must realign the vehicle to the original dimensions according to the manufacturer's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the five types of unitized body damage (sidesway, sag, mash, twist and diamond). NOTE: Diamond on a unitized vehicle is normally unrepairable.	
II. Discuss anchoring vehicle to a repair system.	
III. Explain the corrective pulls to realign the body.	
IV. Describe the problems of over-pulling and creating additional damage.	
V. Demonstrate measuring, anchoring, and pulling vehicle back according to manufacturer's specifications.	V. A. Install vehicle on dedicated or universal bench or anchor down with available equipment. B. Measure vehicle using body data sheet to determine the type(s) of damage. C. Record all damaged measurements. D. Make corrective pulls to realign body to manufacturer's specifications.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Units 15 and 16
Product Service Training Manual
Blackhawk Company Training Manual

TOOLS AND EQUIPMENT

Damaged unitized vehicle, dedicated or universal bench or portable system, tape measure, body data sheet, small hand tools, safety goggles

EVALUATION

The student will measure and determine the type(s) of damage to the vehicle. The student will anchor and pull vehicle back according to the manufacturer's specifications.

Suggested instructional time
20 class periods

DUTY: METAL STRAIGHTENING, SIMPLE (BODY PANEL AND FENDER STRAIGHTENING)

TASK: Pick, file, and finish metal

PERFORMANCE OBJECTIVE

Given a vehicle with a damaged area, the student must straighten the damage by using the pick and file method. Finish metal in preparation for primer surfacer. Work must be smooth to the touch and conform to the original contour of the body.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the tools used in straightening a simple panel.	
II. Discuss what to look for in determining high or low areas.	II. A. Inspect vehicle and panel damage. B. Select proper tools. C. Determine high or low areas in surface. D. Use pick hammer to raise low areas. E. Use metal file to cut down high spots and imperfections made by pick hammer. F. Select proper disc grinder and grind out file marks. G. Featheredge paint and finish in preparation for primer surfacer. H. Glaze with body filler or putty as required.
III. Demonstrate the use of a pick hammer to raise low areas.	
IV. Demonstrate the use of a metal file to cut down high spots.	
V. Demonstrate using the grinder and body filler when necessary.	

VI. Demonstrate the proper way to featheredge in preparation for primer surfacer.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 17

TOOLS AND EQUIPMENT

Vehicle with damaged panel, pick hammer, metal file, air or electric grinder with grinding disc, body filler with necessary supplies, safety goggles

EVALUATION

The student will straighten damaged area of vehicle by using pick and file method. Finish metal in preparation for primer surfacer. Work must be smooth to the touch and conform to the original contour of the body.

Suggested instructional time
20 class periods

DUTY: METAL STRAIGHTENING, SIMPLE (BODY PANEL AND FENDER STRAIGHTENING)

TASK: Straighten deformed auto body sheet metal

PERFORMANCE OBJECTIVE

Given a vehicle with deformed sheet metal (a minimum of 3 panels), the student must straighten and align panels. All high and low spots will be removed and all contours will conform to original shape.

LEARNING ACTIVITIES

I. Discuss the importance of inspecting the damaged area.

II. Discuss the necessary tools and what parts should be removed in order to repair the area.

III. Demonstrate the procedure used in alignment of the panel.

IV. Demonstrate welding any torn metal or shrinking metal if necessary.

V. Demonstrate checking for high and low spots with body file.

VI. Demonstrate replacing any items removed during repair.

VII. Review the procedure by listing the steps necessary to straighten and align panels.

PERFORMANCE GUIDE

VII. A. Inspect damage.
B. Select tools.
C. Remove necessary parts.
D. Pull and/or bump out folds, creases, and dents.
E. Weld torn metal as necessary.
F. Shrink metal if necessary.
G. Line up beads, flanges, and openings as necessary.

H. Check for high and low spots with body file.
I. Replace upholstery and trim as necessary.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 17

TOOLS AND EQUIPMENT

Damaged vehicle, small hand tools, body tools, hammers, dollies, metal file, dent puller, drill motor, oxyacetylene outfit, safety goggles

EVALUATION

The student will straighten and align panels on a vehicle with deformed sheet metal panels. All high and low spots will be removed and all contours will conform to original shape.

V-TECS 10

Suggested instructional time
20 class periods

DUTY: METAL STRAIGHTENING, SIMPLE (BODY PANEL AND FENDER STRAIGHTENING)

TASK: Fill and smooth depressed areas with body filler

PERFORMANCE OBJECTIVE

Given a vehicle or vehicles with a minimum of three (3) roughed out panels, the student must fill and smooth depressed area to original contour.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the roughed out panel and the tools used to repair it.	
II. Demonstrate using the grinder.	
III. Demonstrate mixing the plastic body filler and applying it.	
IV. Demonstrate rough cutting the plastic body filler.	
V. Demonstrate smoothing down and featheredging the body filler using speed file or sanding board.	
VI. Have students fill and smooth depressed area to the vehicle's original contour.	VI. A. Inspect roughed out panels. B. Select grinder and disc. C. Secure safety glasses. D. Grind panels. E. Select proper tools to work body filler. F. Determine amount of body filer required. G. Mix filler to conform with contour of panels. H. Apply body filler to conform with contour of panels. I. Check for hardness.

J. Use rasp or cheese grader file to rough cut.

K. Use necessary sanding equipment to smooth and featheredge.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 7

TOOLS AND EQUIPMENT

Damaged panel, grinder and disc, safety goggles, plastic body filler and harner, plastic spreader, rasp, speed file or sanding board, sandpaper for featheredging

EVALUATION

The student will fill and smooth depressed area to original contour of a given roughed out panel on a vehicle.

Suggested instructional time
10 class periods

DUTY: METAL STRAIGHTENING, SIMPLE (WELDING)

TASK: Cold shrinking metal

PERFORMANCE OBJECTIVE

Given a stretched piece of light gauge sheet metal, a hammer, and a dolly, the student must perform the cold shrinking process to the instructor's satisfaction.

LEARNING ACTIVITIES

I. Discuss the equipment and procedure for cold shrinking metal.

II. Demonstrate using a slapping spoon to cold shrink metal.

III. Demonstrate using a hammer and dolly to cold shrink metal.

IV. Explain the purpose for cold shrinking metal.

V. Have students demonstrate the procedure of cold shrinking metal.

PERFORMANCE GUIDE

V. A. Carefully observe the instruction for using a slapping spoon.
   B. To cold shrink using a slapping spoon, locate the stretch area.
   C. Place dolly under lowest point of indentation.
   D. Slap panel with slapping spoon. (NOTE: This action shocks the metal and allows it to return to normal position by release and directive.)
   E. Metal returns to normal position. (NOTE: Several blows with the slapping spoon may be necessary to shock the metal causing release.)

F. To cold shrink using a hammer and dolly, first locate the stretch area.
G. Place shrinking dolly under stretched area.
H. Drive metal down into the concave part of shrinking dolly using the cross peen end of the shrinking hammer. (NOTE: Some body repairers prefer to use a pick hammer. Depressions are smaller and may be spread over the entire area to be shrunk.)
I. Metal returns to its proper position. (NOTE: Shrinking is accomplished by drawing the stretched area into the dolly, thus controlling it.)
J. Fill the depression caused by drawing the stretch metal into the shrinking dolly. (NOTE: Either body lead or plastic filler may be used.)

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 17

TOOLS AND EQUIPMENT

Light gauge sheet metal, shrinking dolly, shrinking hammer, pick hammer, slapping spoon, safety glasses

EVALUATION

The student will perform the cold shrinking process to the instructor's satisfaction using a stretched piece of light gauge sheet metal, a hammer, and a dolly.

Suggested instructional time
20 class periods

DUTY: METAL STRAIGHTENING, SIMPLE

TASK: Patching and filling rusted out areas

PERFORMANCE OBJECTIVE

Given a rusted out panel requiring repair, the student must remove the damaged area and cut out and shape a new patch panel. The panel must be welded in place and finished to original contour.

LEARNING ACTIVITIES

I. Discuss the damaged area to be repaired and the tools to be used.

II. Demonstrate cutting out the rusted out area.

III. Demonstrate cutting out and shaping a new patch panel.

IV. Demonstrate welding in a new patch panel.

V. Demonstrate grinding and filling in area with body filler.

VI. Review the steps required to patch and fill rusted out area.

PERFORMANCE GUIDE

VI. A. Inspect and study repair to be made.
  B. Select proper tools, materials, and safety equipment.
  C. Remove the rusted out area.
  D. Fabricate a new patch panel.
  E. Pop rivit panel to hold in position.
  F. Weld in a new panel.
  G. Grind welds and area around the new panel.
  H. Mix and apply body filler.
  I. Finish off area to original contour.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 17

TOOLS AND EQUIPMENT

Rusted out panel, sheetmetal, snips, grinder, safety goggles, panel, spot welder or M.I.G. welder, plastic body filler, sanding blocks, sand paper

EVALUATION

The student will remove damaged area of the panel and cut out and shape a new patch panel. The panel must be welded in place and finished to original contour.

Suggested instructional time
10 class periods

DUTY: METAL STRAIGHTENING, SIMPLE (BODY PANEL AND FENDER STRAIGHTENING)

TASK: Repair fiberglass

PERFORMANCE OBJECTIVE

Given a fiberglass panel requiring repair, the student must remove damaged material, fill damaged area with proper mixture of resin and fiberglass and finish to original contour.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the purpose and properties of fiberglass.	
II. Discuss the tools and safety measures to be taken with fiberglass.	
III. Demonstrate preparing a damaged panel for repair.	
IV. Demonstrate mixing resin and activator.	
V. Demonstrate applying resin and fiberglass to damaged panel.	
VI. Demonstrate leveling and featheredging repaired panel using grinder and sanding blocks.	VI. A. Inspect and study repair to be made. B. Select proper tools, materials, and safety equipment. C. Remove the damaged material (if necessary). D. Fill the damaged area with proper mixture of resin and fiberglass. E. Allow the activated resin to cure and harden. F. Finish repaired area to original contour. G. Reinforce damaged area before filling.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 18

TOOLS AND EQUIPMENT

Damaged fiberglass panel, grinder and disc, safety goggles, dust mask, backing tape, fiberglass and resin, scissors, brush, sanding block, sandpaper, activator

EVALUATION

The student will remove damaged fiberglass panel, fill damaged area with proper mixture of resin and fiberglass and finish to original contour.

Suggested instructional time
4 class periods

DUTY: WELDING

TASK: Setting up oxyacetylene equipment

PERFORMANCE OBJECTIVE

Given oxyacetylene equipment, the student must correctly and safely set up the oxyacetylene equipment according to the instructor's directions.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the safety procedures that must be taken when using oxyacetylene equipment.	
II. Discuss the parts of the oxyacetylene equipment and the functions each performs.	
III. Demonstrate the procedures in setting up the oxyacetylene equipment.	III. A. Fasten cylinders in a vertical position. B. Remove caps from cylinders. C. Crack valves of each cylinder; then close valves. D. Connect oxygen regulator to oxygen cylinder. 1. Turn pressure adjusting screw on regulator counterclockwise until tension on spring is released. 2. Slowly open cylinder and tighten in open position. E. Connect acetylene regulator to acetylene.

1. Turn pressure adjusting screw on regulator counterclockwise until tension on spring is released.
2. Open cylinder valve 1/2 to 3/4 of a turn (never more than 1 1/2 turns).

F. Connect acetylene hose (red) to acetylene regulator and purge-hose. (NOTE: All acetylene fittings have a grooved nut to indicate left-hand threads.)

G. Connect oxygen hose (green) to oxygen regulator and purge hose. (NOTE: All oxygen fittings have right-hand threads.)

H. Connect torch body to oxygen and acetylene hose and close both valves on torch body.

I. Attach welding tip to torch body. (NOTE: Size of tip is determined by thickness of metal to be welded. Use manufacturer's recommendations for tip size and working pressurers.)

J. Turn pressure adjusting screw on oxygen regulator clockwise until working pressure is reached.

K. Turn pressure adjusting screw on acetylene regulator clockwise until working pressure is reached.

L. Test all connections for leaks with Ivory soapsuds and water.
M. Check all cylinder, regulator, and torch valves to make sure they are turned off.
N. Open acetylene cylinder valve 1/2 to 3/4 of a turn. (CAUTION: Never open more than 1 1/2 turns.)
O. To purge line, open acetylene valve on torch one turn.
P. Turn acetylene regulator pressure adjusting screw clockwise until desired working pressure is reached.
Q. Close acetylene valve on torch.
R. Open oxygen cylinder valve all the way and tighten it in open position.
S. Open oxygen torch valve one turn.
T. Turn oxygen regulator pressure adjusting screw clockwise until desired pressure is reached.
U. Close oxygen valve on torch.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 10

TOOLS AND EQUIPMENT

Oxygen and acetylene bottles, regulators, hoses, torch body, tips, safety protection

EVALUATION

The student will correctly and safely set up the oxyacetylene equipment according to the instructor's directions.

Suggested instructional time
4 class periods

DUTY: WELDING

TASK: Adjusting the oxyacetylene torch and observing the various flames

PERFORMANCE OBJECTIVE

Given the oxyacetylene torch, the student must light and adjust the torch for neutral, carburizing, and oxidizing flames according to the instructor's directions.

LEARNING ACTIVITIES

I. Discuss the safety procedures that must be taken when using oxyacetylene equipment.

II. Demonstrate the procedures for lighting the torch.

III. Demonstrate and explain the neutral flame.

IV. Demonstrate and explain the carburizing flame.

V. Demonstrate and explain the oxidizing flame.

VI. Review the procedure by having students light and adjust the torch for the three kinds of flames.

PERFORMANCE GUIDE

VI. A. Listen to instruction on the adjustments of the oxyacetylene torch flame.
- B. Open acetylene valve on torch 1/4 turn.
- C. Crack oxygen valve on torch.
- D. Light the torch with flint lighter and adjust until smoke on flame clears.
- E. Adjust oxygen torch valve to neutral flame with a tiny trace of feather on the inner cone. (NOTE: The working pressure is determined by the size of the tip.)

F. To produce a carburizing flame, reduce the supply of oxygen by slowly closing the oxygen torch valve until an excess acetylene feather is produced.

G. To produce an oxydizing flame, increase the supply of oxygen by slowly opening the oxygen torch valve until a short, white, inner cone is produced.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 11

TOOLS AND EQUIPMENT

Oxyacetylene equipment, safety protection

EVALUATION

The student will light and adjust the torch for neutral, carburizing, and oxidizing flames according to the instructor's directions.

V-TECS 22

Suggested instructional time
3 class periods

DUTY: WELDING

TASK: Turning off the torch and oxyacetylene unit

PERFORMANCE OBJECTIVE

Given oxyacetylene equipment, the student must correctly demonstrate the oxyacetylene equipment turning-off procedures according to the instructor's directions.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the importance of closing down oxyacetylene equipment.	
II. Demonstrate how to close down equipment.	II. A. Close acetylene torch valve. B. Close oxygen torch valve. C. Close acetylene cylinder valve. D. Close oxygen cylinder valve. E. Open acetylene torch valve. (NOTE: When gauges reach 0, release acetylene regulator pressure-adjusting screw and close torch valve.) F. Open oxygen valve on torch. (NOTE: When gauges reach 0, release oxygen regulator pressure-adjusting screw and close torch valve.) G. Place torch and hoses on hanger or brackets.
III. Demonstrate how to release pressure on gauges.	
IV. Discuss importance of properly placing torch and hoses back on hangers or brackets.	

V. Have students demonstrate the procedure of turning off oxyacetylene equipment.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Units 10 and 11

TOOLS AND EQUIPMENT

Oxyacetylene equipment, safety protection

EVALUATION

The student will correctly demonstrate the oxyacetylene equipment turning-off procedures according to the instructor's directions.

Suggested instructional time
6 class periods

DUTY: WELDING

TASK: Running a bead without filler rods

PERFORMANCE OBJECTIVE

The student must run a bead on light gauge metal in the vertical, horizontal, overhead, and flat positions without a filler rod and according to the instructor's standards.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the equipment and procedure in running a bead without a filler rod.	
II. Demonstrate selecting the proper welding tip, gas pressure, and safety equipment.	
III. Demonstrate lighting the torch and adjusting it to a neutral flame.	
IV. Demonstrate placing the inner cone about 1/16" to 1/8" from metal.	
V. Demonstrate beginning your travel once a molten puddle is established.	V. A. Observe the instruction on running a bead. B. Select proper welding tip, gas pressure, and safety equipment. C. Prepare metal for welding. D. Place metal in welding position. E. Turn on oxyacetylene unit. F. Set working pressure (according to manufacturer's recommendations). G. Light torch and adjust to a neutral flame.

H. Place inner cone about 1/16" to 1/8" from metal.
I. Do not begin travel until you have established a molten puddle.
J. Hold torch 30° to 45° from center in direction of travel.
K. Slowly move the torch forward allowing the metal to melt.
L. Repeat process until instructor gives permission to go on to next job.
M. Run beads on strips of light gauge sheet metal (1 1/4" x 6") in all four positions.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 11

TOOLS AND EQUIPMENT

Oxyacetylene equipment including safety equipment, welding goggles, fire extinguisher, light gauge sheet metal

EVALUATION

The student will run a bead on light gauge metal in the vertical, horizontal, overhead, and flat positions without a filler rod according to the instructor's standard.

V-TECS 25

Suggested instructional time
6 class periods

DUTY: WELDING

TASK: Running a bead with filler rods

PERFORMANCE OBJECTIVE

Given light gauge metal (1/16", 3/32" and 1/8"), the student must run beads in all four positions using filler rods. The beads must meet the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the equipment and procedure for running a bead with a filler rod.	
II. Demonstrate selecting the proper welding tip, gas pressure, and safety equipment.	
III. Demonstrate lighting the torch and adjusting it to a neutral flame.	
IV. Demonstrate placing the inner cone about 1/16" to 1/8" from the metal and holding torch 30° to 45° from center.	
V. Demonstrate beginning your travel once a molten puddle is established, adding filler rod to the front edge of the puddle in front of the torch.	
VI. Demonstrate adding rod and withdrawing rod to front edge of the puddle as you move forward, keeping the puddle the same size and shape the entire length of the bead.	VI. A. Listen and observe instruction. B. Prepare metal for welding. C. Place metal in welding position. D. Turn on oxyacetylene unit. E. Set working pressure (according to manufacturer's recommendations).

F. Light torch and adjust to a neutral flame.
G. Hold torch 30° to 45° from center.
H. Place inner cone about 1/16" to 1/8" from surface of puddle.
I. Do not begin travel until you have established a molten puddle.
J. Add filler rod to front edge of puddle in front of torch.
K. Move puddle forward with torch and allow puddle to form in base metal.
L. Add rod and withdraw rod to front edge of puddle as you move puddle forward.
M. Keep puddle the same size and shape the entire length of the bead.
N. Show bead to instructor when completed.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 11

TOOLS AND EQUIPMENT

Oxyacetylene equipment including safety equipment, welding goggles, fire extinguisher, light gauge sheet metal, filler rod

EVALUATION

The student will run beads in all four positions using filler rods. The beads must meet the instructor's specifications.

V-TECS 26

Suggested instructional time
15 class periods

DUTY: WELDING

TASK: Welding joints

PERFORMANCE OBJECTIVE

Given a 3/32" mild steel filler rod, the student must weld a butt, flange, corner, lap, and tee joint in all four positions. The joints will be evaluated according to the instructor's standards.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the equipment and procedure for welding joints.	
II. Demonstrate selecting the proper welding tip, gas pressure, and safety equipment.	
III. Demonstrate lighting the torch and adjusting it to a neutral flame.	
IV. Demonstrate placing the inner cone about 1/16" to 1/8" from metal and holding torch 30° to 45° from center.	
V. Demonstrate beginning your travel once a molten puddle is established, adding filler rod to the front edge of the puddle in front of the torch.	
VI. Demonstrate adding rod and withdrawing rod to front edge of the puddle as you move forward, keeping the puddle the same size and shape the entire length of the bead.	
VII. Demonstrate welding a butt, flange, corner, lap and tee joint in all four positions -- vertical, horizontal, flat, and overhead.	VII. A. Observe instruction. B. Select proper welding tip, gas pressure, and safety equipment.

C. Prepare metal for welding.
D. Place metal in welding position.
E. Turn on oxyacetylene unit.
F. Set working pressure (according to manufacturer's recommendation).
G. Light torch and adjust to a neutral plane.
H. Tack weld metal together at both ends of joint.
I. Hold torch 30° to 45° from center.
J. Do not begin travel until you have established a molten puddle.
K. Place inner cone about 1/16" to 1/8" from surface of puddle.
L. Add filler rod to front edge of puddle in front of torch.
M. Move puddle forward with torch and allow puddle to form in base metal.
N. Add rod and withdraw rod to front edge of puddle as you move pudle forward.
O. Keep puddle the same size and shape the entire length of the bead.
P. Weld a butt, flange, corner, lap, and tee joint.
Q. Weld each joint in all four positions — vertical, horizontal, flat, and overhead.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 11

TOOLS AND EQUIPMENT

Oxyacetylene equipment including safety equipment, welding goggles, fire extinguisher, light gauge sheet metal, 3/32" steel filler rod

EVALUATION

The student will weld a butt, flange, corner, lap, and tee joint in all four positions. The joints must be rated acceptable according to the instructor's standards.

Suggested instructional time
7 class periods

DUTY: WELDING

TASK: Brazing with brass rods

PERFORMANCE OBJECTIVE

Given 3/32" and 1/8" fluxed brass filler rods and light gauge sheet metal, the student must braze a butt, lap, and spot plug weld in all four positions. The performance will be evaluated according to the instructor's standards.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the equipment and procedure for brazing.	
II. Demonstrate selecting the proper welding tip, gas pressure, and safety equipment.	
III. Demonstrate cleaning the metal for brazing.	
IV. Demonstrate lighting the torch and adjusting it to a neutral or slightly oxidized flame.	
V. Demonstrate heating the end of the brazing rod and dipping it into the brazing flux.	
VI. Demonstrate heating the surface of the weld area slightly, holding the torch 30° to 45° from vertical while holding the brazing rod at the same angle in the opposite direction.	
VII. Demonstrate melting a small amount of brass rod onto the surface and allowing it to spread along the entire seam when a dull cherry-red color occurs.	VII. A. Observe instruction. B. Prepare metal for brazing -- clean. C. Place metal in brazing position -- 1/16" to 1/8" apart. D. Turn on oxyacetylene unit.

E. Adjust proper working pressure of oxygen and acetylene. (Use manufacturer's recommendation.)
F. Place metal on fire brick. (NOTE: Do not lay metal flat on brick. Arrange metal so that a small space will be between the bare metal and the fire brick.)
G. Light and adjust the torch to a neutral or slightly oxidized flame.
H. Preheat the end of the brazing rod and dip it in the flux or use fluxed rod.
I. Practice running beads on flat, light gauge metal.
J. Tack metal in place using braze filler metal.
K. Heat the surface of the weld area slightly.
L. Hold torch 30° to 45° from vertical; hold filler rod at the same angle in opposite direction.
M. Melt a small amount of brass rod onto the surface and allow it to spread along the entire seam when a dull cherry-red color occurs.
N. When the base metal is tinned sufficiently, start depositing the proper size bead.
O. Watch for base metal color.
P. Inspect weld; then check with instructor.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 12

TOOLS AND EQUIPMENT

Oxyacetylene equipment including safety equipment, welding goggles, fire extinguisher, light gauge sheet metal, coated brass filler rod or brass filler rod and flux

EVALUATION

The student will blaze a butt, lap and spot plug weld in all four positions. The performance must be rated acceptable according to instructor's standards.

Suggested instructional time
4 class periods

DUTY: WELDING

TASK: Setting up equipment for oxyacetylene cutting

PERFORMANCE OBJECTIVE

Given the proper equipment, the student must set up the oxyacetylene equipment for cutting. The student will demonstrate the procedure and explain the function of each piece of equipment according to the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the equipment and procedure used in setting up for oxyacetylene cutting.	
II. Demonstrate selecting the proper cutting tip, gas pressure, and safety equipment.	
III. Demonstrate setting up the oxyacetylene cutting equipment.	
IV. Have students practice setting up the equipment and welding station.	IV. A. Observe the instruction on setting-up oxyacetylene cutting equipment. B. Fasten cylinders in a vertical position. C. Remove caps from cylinders. D. Crack valves of each cylinder, then close valves. E. Connect oxygen regulator to oxygen cylinder. 1. Turn adjusting screw on regulator counterclockwise until tension on spring is released. 2. Slowly turn cylinder valve wide open.

F. Connect acetylene regulator to acetylene cylinder.
    1. Turn adjusting screw on regulator counterclockwise until tension on spring is released.
    2. Open cylinder valve 1/2 to 3/4 of a turn (never more than 1 1/2 turns).

G. Connect acetylene hose to acetylene regulator and purge hose.

H. Connect oxygen hose to oxygen regulator and purge hose.

I. Connect torch body to oxygen and acetylene hose and close both valves on torch body.

J. Attach cutting attachment to torch body. (NOTE: The size tip is determined by the thickness of metal to be cut.)

K. Close oxygen preheat valve on cutting attachment.

L. Turn adjusting screw on oxygen regulator clockwise until working pressure is reached.

M. Turn adjusting screw on acetylene regulator clockwise until correct working pressure is reached.

N. Test all connections for leaks with Ivory soap suds and water. (NOTE: Apply soap suds with a clean paint brush.)

V. Explain the safety precautions which should be used with this equipment.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 11

TOOLS AND EQUIPMENT

Oxyacetylene equipment with cutting attachment, safety equipment, welding goggles, fire extinguisher, soap suds, paint brush, water

EVALUATION

The student will set up the oxyacetylene equipment for cutting. The student will demonstrate the procedure and explain the function of each piece of equipment according to instructor's specifications.

Suggested instructional time
4 class periods

DUTY: WELDING

TASK: Lighting and adjusting the torch for oxyacetylene cutting

PERFORMANCE OBJECTIVE

Given the oxyacetylene cutting equipment, the student must be able to light and adjust the equipment for cutting to the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the equipment and procedure for lighting and adjusting the torch for oxyacetylene cutting.	
II. Demonstrate selecting the proper cutting tip, gas pressure, and safety equipment.	
III. Demonstrate lighting and adjusting the torch for oxyacetylene cutting.	
IV. Demonstrate closing down equipment when cutting is completed.	
V. Have students practice lighting and adjusting the equipment.	V. A. Observe instruction. B. Check all cylinder, regulator, and torch valves to make sure they are off. C. Open acetylene cylinder valve 1/2 to 3/4 of a turn (never more than 1 1/2 turns). D. Open acetylene valve on torch one turn. E. Turn adjusting screw on acetylene regulator clockwise until desired pressure is reached*. F. Close acetylene valve on torch.

*Oxygen and acetylene pressures and size of tip depend upon the thickness of metal to be cut. Use pressures and tip size recommended by manufacturer.

G. Open oxygen cylinder valve all the way.
H. Open oxygen preheat valve on cutting attachment one turn.
I. Open oxygen preheat valve on cutting attachment one turn.
J. Turn adjusting screw on oxygen regulator clockwise until desired pressure is reached.*
K. Close oxygen preheat valve on cutting attachment.
L. Open acetylene valve on torch 1/4 turn.
M. Light the torch with flint lighter and adjust until smoke on flame clears.
N. Open oxygen preheat valve slowly and adjust to a neutral flame.
O. Depress the oxygen cutting lever and check to see that a neutral flame is present. (NOTE: If necessary, adjust the oxygen preheat valve with the oxygen cutting lever depressed until a neutral flame is secured.)
P. To turn off torch, close acetylene valve on torch.
Q. Close oxygen preheat valve.
R. Close acetylene cylinder valve.
S. Close oxygen cylinder valve.
T. Open acetylene valve on torch.

---

*Oxygen and acetylene pressures and size of tip depend upon the thickness of metal to be cut. Use pressures and tip size recommended by manufacturer.

U. (NOTE: When gauges reach 0, close oxygen preheat valve and release adjusting screw on oxygen regulator by turning counterclockwise.)
V. Open oxygen valve on torch.
W. Close oxygen valve on torch.
X. Place torch and hose on hanger or brackets provided.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 11

TOOLS AND EQUIPMENT

Oxyacetylene equipment with cutting attachment, welding goggles, fire extinguisher

EVALUATION

The student will light and adjust the equipment for cutting according to instructor's specifications.

V-TECS 30A

Suggested instructional time
6 class periods

DUTY: WELDING

TASK: Oxyacetylene cutting (90° cut and restart cut)

PERFORMANCE OBJECTIVE

Given 1/4" mild steel and oxyacetylene cutting equipment, the student must make a 90° cut and a restart cut according to the instructor's specifications.

LEARNING ACTIVITIES

I. Discuss the equipment and procedure for oxyacetylene cutting.

II. Demonstrate selecting the proper cutting tip, gas pressure, and safety equipment.

III. Demonstrate adjusting oxygen and acetylene regulator, and adjusting to neutral flame.

IV. Demonstrate holding preheat flame with tip of inner cone 1/16" to 1/8" above top of plate at right angle until red spot appears.

V. Demonstrate depressing the oxygen cutting lever and move from right to left across the plate.

PERFORMANCE GUIDE

V. A. Observe instruction on oxyacetylene cutting.
B. Select proper safety equipment.
C. To make a 90° cut, mark four parallel lines 2" apart on plate to be cut.
D. Adjust oxygen regulator.
E. Adjust acetylene regulator.
F. Place plate to be cut over slag box.
G. Light torch.
H. Adjust to neutral flame.
I. Assume comfortable position.

J. Place hoses behind operation.
K. Maneuver torch with both hands.
L. Hold preheat flame with tip of inner cone 1/16" to 1/8" above top of place at right edge until red spot appears.
M. Depress the oxygen cutting lever, and move from right to left across the plate (for left-handed operators, go from left to right).
N. Hold the tip at right angles to work while cutting with inner cone being 1/16" to 1/8" above work.
O. Make 90° cuts until you have developed the proper procedure.
P. Cool metal by placing in can of water with the aid of pliers.
Q. Show samples to instructor for approval and grading.
R. To restart a cut, release the oxygen cutting lever.
S. Preheat edge (only) where cutting action was stopped.
T. Slowly depress oxygen cutting lever and continue.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 11

TOOLS AND EQUIPMENT

Oxyacetylene equipment with cutting attachment, welding goggles, fire extinguisher, 1/4" mild steel, pliers, gloves

EVALUATION

The student will make a 90° cut and a restart cut using 1/4" mild steel and oxyacetylene cutting equipment. The cuts must meet the instructor's specifications.

Suggested instructional time
6 class periods

DUTY: WELDING

TASK: Oxyacetylene cutting (beveled cut and hole cut)

PERFORMANCE OBJECTIVE

Given 1/4" mild steel and oxyacetylene cutting equipment, the student must make a beveled cut and a hole cut to the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the equipment and procedure for oxyacetylene cutting.	
II. Demonstrate selecting the proper cutting tip, gas pressure, and safety equipment.	
III. Demonstrate adjusting oxygen and acetylene regulator, and adjusting to neutral flame.	
IV. Demonstrate holding preheat flame with tip of inner cone 1/16" to 1/8" above top of plate at right angle until red spot appears.	
V. Demonstrate depressing the oxygen cutting lever and move from right to left across the plate.	V. A. Observe the instructions for making beveled cuts. B. Place one piece of 3/8" to 1/2" plate 2" x 6" on slag box or cutting table. C. Light and adjust cutting torch to a neutral flame. (Note: Oxygen cutting pressures are greater for bevel cuts than 90° cuts.) D. Place hoses behind operator. E. Hold torch with both hands at desired angle to metal as shown.

F. Hold preheat flame with tip of inner cone (neutral flame) 1/16" to 1/8" above top of place at right edge until red spot appears.
G. Depress oxygen cutting lever and proceed across plate with very consistent movement. Be careful to maintain constant travel speed, torch angle, and flame to work distance.
H. Practice until you develop the proper procedure.
I. Turn in exercises for instructor's approval and grading.
J. Review the instruction for making a hole cut.
K. Draw two circles on metal.
    1. 1" in diameter, 1" from edge
    2. 1/2" in diameter, 1" from edge
L. Adjust oxygen regulator.
M. Adjust acetylene regulator.
N. Place metal to be cut over slag box.
O. Light torch.
P. Adjust to neutral flame.
Q. Assume comfortable position.
R. Place hoses behind operator.
S. Maneuver torch with both hands.
T. Hold tip of inner cone 1/16" to 1/8" above point to be cut until metal turns bright red.

    1. Tilt torch 15° from vertical position (NOTE: This will allow molten metal to be blown away from operator).
    2. Depress oxygen cutting lever slowly moving torch backwards (to the operator's right if right-handed) until cut pierces plate.

U. Return cutting torch to vertical position.
    1. Raise cutting tip until tip of inner cone is from 1/4" to 1/2" above the plate.
    2. Make cut.

V. Cut just inside soapstone mark until circular cut is completed.

W. Repeat steps 21 and 22 until all holes are cut.

X. Cool metal by placing in can of water with the aid of pliers.

Y. Show samples to instructor for approval and grading.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 11

TOOLS AND EQUIPMENT

Oxyacetylene equipment with cutting attachment, welding goggles, fire extinguisher, 1/4" mild steel, pliers, gloves

EVALUATION

The student will make a beveled cut and a hole cut to the instructor's specifications using 1/4" mild steel and oxyacetylene cutting equipment.

Suggested instructional time
12 class periods

DUTY: WELDING

TASK: Heat shrinking metal

PERFORMANCE OBJECTIVE

Given a stretched piece of light gauge sheet metal, a hammer, and a dolly, the student must perform the shrinking process to the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the equipment and procedure for heat shrinking metal.	
II. Demonstrate heat shrinking raised metal by heating a spot at the center of the bulge.	
III. Demonstrate driving down the softened high spot using a shrinking hammer. Straighten the shrunk area using a hammer and dolly. Quench hot metal using a wet sponge. (NOTE: Too much contraction due to cooling could cause the panel to buckle.)	
IV. Demonstrate heat shrinking gouged metal by heating the entire area.	
V. Demonstrate driving up the softened low spot using a dolly. Straighten the shrunk area using a hammer and a dolly. Quench hot metal using a wet sponge. (NOTE: Too much concentration due to cooling could cause the panel to buckle.)	V. A. Observe instruction carefully. B. To heat shrink raised metal, heat a spot at the center of bulge. (NOTE: Use a neutral flame and wear gloves). Several spots may be necessary. C. Drive down softened high spot using a shrinking hammer. D. Straighten the shrunk area using a hammer and dolly.

E. Quench hot metal with wet sponge. (NOTE: It is not always desirable to quench the shrunk panel. Too much contraction due to cooling could cause the panel to buckle.)
F. To heat shrink gouged metal, first heat the gouge. (NOTE: When shrinking a gouge, heat the entire length, use a neutral flame, and wear gloves.)
G. Drive up the heated area using the dolly block. (NOTE: If spot is not accessible, a pry tool or extended dolly might have to be used.)
H. Level the high and low spots; hammer off the dolly technique.
I. Relieve overshrinking; hammer on the dolly technique.
J. Quench the hot metal. (NOTE: It is not always desirable to quench the shrunk panel. Too much contraction due to cooling could cause the panel to buckle.)

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Units 12-17

TOOLS AND EQUIPMENT

Oxyacetylene equipment, welding goggles, fire extinguisher, light gauge sheet metal, gloves, dolly block, body hammer, water, pail, sponge

EVALUATION

The student will perform the shrinking process on a stretched piece of light gauge sheet metal with a hammer and a dolly. His/her performance must meet the instructor's specifications.

SC-6

Suggested instructional time
4 class periods

DUTY: WELDING

TASK: Set up electric welding equipment and run a bead

PERFORMANCE OBJECTIVE

Given electric welding equipment, the student must be able to set up the electric welding equipment and run a bead in the horizontal position. All safety precautions must be followed and the procedure must meet the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the safety procedures to follow when using electric welding equipment.	
II. Identify the parts of the equipment and each one's use.	
III. Demonstrate setting up the electric welding equipment.	
IV. Demonstrate running a bead on a piece of steel plate placed in the horizontal position.	IV. A. Listen and observe the instruction. B. Select proper welding heat on the electric welder. C. Select the proper safety equipment. D. Place metal in welding position. E. Hook up ground clamp. F. Strike the electrode on the metal being welded. G. Once the arc is struck, the distance between the electrode and the metal should be equal to the electrode diameter.

H. As the electrode melts down, move in a steady motion with the electrode holder downward and moving in the direction of travel.

V. Have students practice setting up the equipment and running a bead.

RESOURCES

Rhone and Yates. **Total Body Repair**, Unit 13

TOOLS AND EQUIPMENT

Electric welder, welding helmet, gloves, electrodes, steel plate

EVALUATION

The student will set up the electric welding equipment and run a bead in the horizontal position according to the instructor's specifications.

SC-7

Suggested instructional time
4 class periods

DUTY: WELDING

TASK: Set up MIG welding equipment and run a bead

PERFORMANCE OBJECTIVE

Given metallic inert gas (MIG) welding equipment, the student must set up the MIG welding equipment and run a bead in the horizontal position. All safety precautions must be followed and the procedure must meet the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the safety procedures for using MIG welding equipment.	
II. Identify the parts of the equipment and each one's use.	
III. Demonstrate setting up the MIG welding equipment.	
IV. Demonstrate running a bead on a piece of steel metal placed in the horizontal position.	IV. A. Listen and observe the instruction. B. Select proper welding heat and wire speed on the MIG welder. C. Select the proper safety equipment. D. Place sheet metal in welding position. E. Hook up ground clamp. F. Open up gas cylinder with inert gas. G. Move welding tip to sheet metal until arc appears. H. Once the arc appears, the gas cup should be held 3/8" to 1/2" from sheet metal surface. I. As the welding wire melts, keep the welding tip moving in a steady direction to produce a good bead.

V. Have students practice setting up the equipment and running a bead.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 13

TOOLS AND EQUIPMENT

MIG welder, welding helmet, gloves, sheet metal

EVALUATION

The student will set up the MIG welding equipment and run a bead in the horizontal position according to the instructor's specifications.

Suggested instructional time
4 class periods

DUTY: WELDING

TASK: Run a bead on aluminum in the horizontal position

PERFORMANCE OBJECTIVE

Given metallic inert gas (MIG) welding equipment and aluminum wire, the student must run a bead on aluminum in the horizontal position. All safety precautions must be followed and the procedure must meet the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Review the safety procedures for using MIG welding equipment.	
II. Review the operation of the MIG welding equipment.	
III. Demonstrate setting up the MIG welder for aluminum welding.	
IV. Demonstrate running a bead on a piece of aluminum sheet with aluminum wire in the horizontal position.	IV. A. Listen and observe the instruction. B. Select proper welding heat and wire speed on the MIG welder. C. Install the aluminum gun kit and pure argon shielding gas. D. Select the proper safety equipment. E. Open up the gas cylinder with inert gas. F. Place aluminum sheet in the welding position. G. Hook up the ground clamp. H. Move welding tip to aluminum sheet until arc appears. I. Once the arc appears, the gas cup should be held 3/8" to 1/2" from the aluminum sheet metal surface.

J. As the aluminum welding wire melts, keep the welding tip moving in a steady direction to produce a good bead.

V. Have the students practice running the bead using aluminum wire on an aluminum sheet.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 19

TOOLS AND EQUIPMENT

MIG welder with aluminum wire, welding helmet, gloves, aluminum sheet

EVALUATION

The student will set up the MIG welder with aluminum wire and run a bead in the horizontal position according to the instructor's specifications.

SC-9

Suggested instructional time
4 class periods

DUTY: WELDING

TASK: Set up thermoplastic welding equipment and run a bead

PERFORMANCE OBJECTIVE

Given thermoplastic welding equipment, the student must set up the equipment, identify the plastic, and run a bead using a plastic welding rod. All safety precautions must be followed and the procedure must meet the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the safety procedures for using thermoplastic welding equipment.	
II. Discuss the different types of plastic and demonstrate how to identify each according to the resources listed below.	
III. Explain thermoplastic welding equipment and the different types of welding rods.	
IV. Demonstrate using the thermoplastic welding equipment on a damaged panel.	IV. A. Listen and observe instruction. B. Determine what type of plastic is to be welded according to the instructor's demonstration. C. Set up the thermoplastic welding equipment to make the repair. D. Place damaged panel in the welding position. E. Using the thermoplastic welder, heat the damaged panel, and apply the filler rod.

F. Adjust the heat or speed as needed to bond the filler rod to the damaged panel and achieve good penetration.

V. Have students practice setting up the equipment and running a bead.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 18
Thomas. **Making Better Plastic Welds**

TOOLS AND EQUIPMENT

Thermoplastic welding torch, assorted welding rods, damaged plastic panel

EVALUATION

The student will identify the plastic panel, set up the welding torch, and weld the damaged area using a plastic welding rod according to the instructor's specifications.

SC-10

Suggested instructional time
2 class periods

DUTY: PAINTING AND REFINISHING

TASK: Describe refinishing materials and equipment

PERFORMANCE OBJECTIVE

Given a well-equipped shop, the student must describe the material and equipment used in the shop with 100% accuracy.

LEARNING ACTIVITIES

I. Itemize and describe the materials and equipment used in the auto body repair shop.

II. Identify the different manufacturers of materials, supplies, and equipment found in the auto body repair shop.

III. Discuss the safety precautions used with the materials and equipment.

IV. Emphasize the cost of setting up a complete shop and the replacement value of each item.

V. Discuss obsolescence of some pieces and new procedures.

PERFORMANCE GUIDE

N/A

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 24
Automotive Refinishing Principles and Techniques, Section II

TOOLS AND EQUIPMENT

Well-equipped shop with hand tools, materials, sandpaper, primer, thinner, etc.
Equipment such as paint booth, spray gun, air compressor, air regulators, hoses

EVALUATION

The student will describe the materials and equipment used in auto body repair shop with 100% accuracy.

Suggested instructional time
4 class periods

DUTY: PAINTING AND REFINISHING

TASK: Clean and prepare repaired surfaces for painting

PERFORMANCE OBJECTIVE

Given a vehicle with a primed-in area, the student must clean and prepare primed-in surface area for painting. All foreign material must be removed from surface to be painted.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the materials and procedures used to clean and prepare repaired surfaces for painting.	I. A. Select proper tools and materials. B. Remove all dust and dirt on and around the repaired surface. C. Remove all foreign material from surface (i.e., wax, road film, tar). D. Sand as required. E. Tack surface free of dust and dirt with tack rag.
II. Demonstrate cleaning the area with DuPont-Prep-Sol to remove road tar and film.	
III. Demonstrate sanding area to be painted.	
IV. Demonstrate cleaning the sanding residue with Dupont Enamel and Lacquer Cleaner.	
V. Demonstrate tacking area with tack rag to remove dust.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 26
Automotive Refinishing Principles and Techniques, Section IV

TOOLS AND EQUIPMENT

Panel with primed-in area, DuPont-Prep Sol 3919S, 320 grit sand paper, DuPont-Cleaner 3939S, tack rag, cleaning rags

EVALUATION

The student will clean and prepare primed-in surface area for painting. All foreign material must be removed from surface to be painted.

Suggested instructional time
2 class periods

DUTY: PAINTING AND REFINISHING

TASK: Remove paint and rust

PERFORMANCE OBJECTIVE

Given a vehicle panel requiring paint and rust removal, the student must remove the old paint and rust to bare, clean metal.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the materials and procedures used to remove paint and rust.	I. A. Inspect work requirement. B. Select sandblaster or grinder. C. Obtain necessary safety equipment. D. Use sandblaster or grinder to remove paint and rust. E. Use paint stripper (water rinseable).
II. Discuss the need for wearing rubber gloves and goggles.	
III. Demonstrate using sandblaster to remove rust and paint.	
IV. Demonstrate using grinder to remove rust and paint.	
V. Demonstrate using paint stripper to remove rust and paint.	

RESOURCES

Automotive Refinishing Principles and Techniques, Section IV

TOOLS AND EQUIPMENT

Panel with rust and paint area, grinder, goggles, sandblaster, paint stripper, rubber gloves, brush, putty knife

EVALUATION

The student will remove old paint and rust to bare, clean metal on a vehicle panel.

Suggested instructional time
2 class periods

DUTY: PAINTING AND REFINISHING

TASK: Apply corrosion materials

PERFORMANCE OBJECTIVE

Given a vehicle panel requiring corrosion control metal conditioner, the student must apply metal conditioner. All steps on the instructor's checklist must be rated acceptable.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the materials and procedures used to apply corrosion materials.	I. A. Inspect rusted area to be treated. B. Procure metal conditioner. C. Use rubber gloves and goggles. D. Dilute metal conditioner according to manufacturer's specifications. E. Apply with brush or sponge. F. Scrub area with steel wool. G. Wipe conditioner dry while area is still wet, using clean dry cloths. H. Allow area to dry 10 minutes before applying primer surfacer.
II. Demonstrate diluting metal conditioner according to manufacturer's specifications.	
III. Discuss the need for wearing rubber gloves and goggles.	
IV. Demonstrate applying metal conditioner to rusted area with a brush or sponge.	

V. Demonstrate scrubbing the metal conditioner into the rusted area using a steel wool pad.

VI. Demonstrate using clean cloths to dry up the metal conditioner while it is still wet.

VII. Discuss the need for surface to dry ten minutes before priming.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 26
Automotive Refinishing Principles and Techniques, Section IV

TOOLS AND EQUIPMENT

Panel with rusted area, metal conditioner, rubber gloves, goggles, brush or sponge, steel wool or Scotch-brite pad, clean cloths

EVALUATION

The student will apply metal conditioner on a vehicle panel requiring corrosion control metal conditioner. All steps on the instructor's checklist must be rated acceptable.

V-TECS 15

Suggested instructional time
6 class periods

DUTY: PAINTING AND REFINISHING

TASK: Mask sections and parts

PERFORMANCE OBJECTIVE

Given a vehicle requiring masking, the student must mask the required area. Work must be done within plus or minus (+ or -) 10% of the time set by instructor.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the materials and procedures for masking sections and parts.	
II. Demonstrate using masking tape to mask off area not to be painted.	
III. Demonstrate using masking tape and masking paper to mask off larger areas to be painted.	
IV. Second the amount of time it takes to mask a required area to demonstrate the speed needed to complete the job in a required amount of time.	
V. Explain why the area to be masked must be taped with precision.	V. A. Clean and dry areas to be masked. B. Select tape. C. Select paper. D. Apply tape and paper to area requiring cover.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 24
Automotive Refinishing Principles and Techniques, Section VI

TOOLS AND EQUIPMENT

Vehicle to be masked, masking tape, masking paper

EVALUATION

The student will mask a required area of a vehicle. Work must be done within plus or minus (+ or -) 10% of the time set by the instructor.

Suggested instructional time
4 class periods

DUTY: PAINTING AND REFINISHING

TASK: Apply primer surfacer

PERFORMANCE OBJECTIVE

Given a vehicle requiring the application of primer surfacer coats, the student must spray the vehicle with primer. All small imperfections and scratches must be filled.

LEARNING ACTIVITIES

I. Discuss the materials, equipment, and procedures to follow when applying primer surfacer.

II. Demonstrate featheredging the panel to be primed.

III. Demonstrate mixing the primer surfacer in the spray gun according to the manufacturer's specifications.

IV. Demonstrate setting proper pressure and proper spraying techniques.

V. Demonstrate applying primer surfacer to panel.

VI. Demonstrate applying glazing putty where needed to fill in pin holes of scratches.

PERFORMANCE GUIDE

I. A. Select equipment and materials.
   B. Clean, featheredge, and sand.
   C. Apply glazing as required.
   D. Mix or reduce properly.
   E. Set proper air pressure.
   F. Use proper spraying techniques.
   G. Apply number of coats needed to fill small scratches and imperfections.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 25
Automotive Refinishing Principles and Techniques, Section V

TOOLS AND EQUIPMENT

Air compressor, air regulator, air hose, primer spray gun, primer, thinner, glazing putty, Squeegee, sand paper (80 grit and 240 grit), vehicle, respirator

EVALUATION

The student will spray the vehicle with primer. All small imperfections and scratches must be filled.

Suggested instructional time
2 class periods

DUTY: PAINTING AND REFINISHING

TASK: Paint surfaces

PERFORMANCE OBJECTIVE

Given a vehicle prepared for painting, the student must paint the repaired panel. Paint must be color and gloss matched with no orange peel, runs, or sand scratches.

LEARNING ACTIVITIES

I. Discuss the materials, equipment, and procedures to follow when applying paint to vehicle.

II. Demonstrate mixing and straining the paint to be applied to the vehicle.

III. Demonstrate setting air pressure, and adjusting gas pattern and fluid control.

PERFORMANCE GUIDE

I.
- A. Inspect area to be refinished.
- B. Determine type and amount of paint.
- C. Mix and prepare paint.
  1. Strain paint into cup.
  2. Select proper thinner or reducer.
  3. Reduce paint to assure accurate color match.
  4. Add any additives necessary (i.e., silicone additive, retarder).
- D. Set air pressure.
- E. Adjust pattern and fluid control.
- F. Apply necessary number of coats allowing drying time between coats.

IV. Demonstrate applying paint to the vehicle.

V. Discuss the importance of letting the paint dry between coats and any additives that may be necessary.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 27
Automotive Refinishing Principles and Techniques, Section VIII

TOOLS AND EQUIPMENT

Air compressor, air regulator, air hose, paint spray gun, paint, thinner, paint strainer, respirator, vehicle

EVALUATION

The student will paint the repaired panel. Paint must be color and gloss matched with no orange peel, runs, or sand scratches.

V-TECS 18

Suggested instructional time
2 class periods

DUTY: PAINTING AND REFINISHING

TASK: Heat dry painted surface

PERFORMANCE OBJECTIVE

Given a painted panel requiring heat drying, the student must heat dry the panel. Finished work must have a glossy appearance.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the equipment and procedure to follow when heat drying painted panels.	I. A. Inspect painted panel to select proper equipment. B. Select lamp most suited for drying operation. C. Select proper lamp distance. D. Select proper lamp temperature. E. Select proper time for lamp setting. F. Allow drying time.
II. Demonstrate on a freshly painted panel how to set up the heat lamp.	
III. Demonstrate the correct distance and proper lamp temperature and drying time.	
IV. Discuss what the proper time, distance, and temperature are.	
V. Explain the importance of adequate drying time.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 24
Automotive Refinishing Principles and Techniques, Section II

TOOLS AND EQUIPMENT

Freshly painted panel, heat lamp

EVALUATION

The student will heat dry the freshly painted panel. Finished work must have glossy appearance.

Suggested instructional time
2 class periods

DUTY: PAINTING AND REFINISHING

TASK: Fresh painted surfaces

PERFORMANCE OBJECTIVE

Given a vehicle panel refinished with acrylic lacquer, the student must clean, color, sand, and compound the panel to match gloss or adjacent panels.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the materials and procedures for rubbing out a freshly painted surface.	I. A. Inspect the panel refinished in acrylic lacquer. B. Determine equipment and materials necessary to finish painted surface. C. Color sand with proper sandpaper. D. Remove dirt, grit, and other contaminants from area to be compounded. E. Compound area to match gloss of adjacent panels. F. Polish or wax surface to remove swirl marks and protect finish.
II. Demonstrate color standing with 3M Imperial or 600 grit sandpaper and water.	
III. Demonstrate the use of rubbing compound to remove sanding scratches.	
IV. Demonstrate the use of polish to remove compound scratches.	
V. Explain the damage that occurs when too much sanding is done.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 27
Automotive Refinishing Principles and Techniques, Section VIII

TOOLS AND EQUIPMENT

Clean clothes, painted panel, 3M Imperial or 600 grit sandpaper, rubbing compound, polish, water, pail, sponge

EVALUATION

The student will clean, color, sand, and compound the vehicle panel to match gloss or adjacent panels.

Suggested instructional time
12 class periods

DUTY: REFINISHING COMPLETE ENAMEL

TASK: Refinish vehicle in enamel paint

PERFORMANCE OBJECTIVE

Given a vehicle that needs rebuilding and painting, the student must make repairs and paint the vehicle using enamel paint and have it ready for delivery. The finished vehicle must meet the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss refinishing with enamel.	
II. Discuss how to find out what kind of paint is on car.	
III. Show the following filmstrips. Discuss them with the class. "Sanding Techniques, Tools and Materials" (No. 941-21) "Masking, Priming and Puttying" (No. 941-23) "Surface Prep for Painting" (No. 941-22) "Spraying Color on Vehicle" (No. 941-24)	
IV. Outline the steps and procedures for refinishing the vehicle using enamel paint.	IV. A. Thoroughly clean surface with detergent and water. B. Dry surface with clean rag. C. Wipe surface with a wax and grease remover solvent to remove all wax and grease. D. Repair damages. E. Sand old paint. F. Featheredge with 320 wet sandpaper.

V. Explain the procedure for refinishing in enamel.

G. When damaged area is properly prepared, wipe thoroughly with wax and grease remover. Dry with clean dry cloth and treat bare metal with metal preparation.
H. Tack off with tack rag.
I. Spray prime the bare metal spots with primer surfacer.
J. Mask car.
K. Scuff sand primed areas.
L. Tack off vehicle with tack rag.
M. Mix paint properly.
N. Spray color on vehicle.
O. Allow vehicle to dry overnight.

RESOURCES

Automotive Refinishing Principles and Techniques, Sections VII and VIII.
Filmstrips are from Pentice-Hall Media Center

TOOLS AND EQUIPMENT

Filmstrip projector, screen, cassette tape player, solvents, clean rags, disk sander, orbital sander, hammer and dolly, body filler, half-round files, sandpaper, primer gun, primer surfacer, spray paint gun, paint, reducer, tire black, glass cleaner

EVALUATION

The student will repair and paint vehicle using enamel paint. The finished vehicle must meet the instructor's specifications. Detail the vehicle and get it ready for delivery.

SC-12

Suggested instructional time
6 class periods

DUTY: REFINISHING COMPLETE ENAMEL

TASK: Use acrylic enamel system

PERFORMANCE OBJECTIVE

Given the proper materials, the student must use the acrylic enamel system with 100% accuracy.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the purpose of the acrylic enamel system.	
II. List and discuss the different manufacturers of the acrylic enamel system.	
III. Explain the procedure for mixing and applying the acrylic enamel system.	
IV. Demonstrate mixing and applying the acrylic enamel system according to the manufacturer's specifications.	IV. A. Listen and observe the instruction. B. Determine what materials will be needed to apply acrylic enamel system. C. Mix and apply acrylic enamel system according to manufacturer's specifications.
V. Have students mix and apply the acrylic enamel system observed by the instructor.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 25
Automotive Refinishing Principles and Techniques, Section VIII

TOOLS AND EQUIPMENT

Acrylic enamel, hardener, reducer, spray gun, respirator

EVALUATION

The student will explain and/or demonstrate the procedure for using the acrylic enamel system according to instructor's specifications and with 100% accuracy.

SC-13

Suggested instructional time
9 class periods

DUTY: REFINISHING COMPLETE ENAMEL

TASK: Use polyurethane system

PERFORMANCE OBJECTIVE

Given the proper materials, the student must use the polyurethane system with 100% accuracy.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Explain the purpose of the polyurethane system.	
II. List and discuss the different manufacturers of the polyurethane system.	
III. Describe the procedure for mixing and applying the polyurethane system.	
IV. Demonstrate mixing and applying the polyurethane system according to manufacturer's specifications.	IV. A. Listen and observe the instruction. B. Determine what materials will be needed to apply the polyurethane system. C. Mix and apply polyurethane paint according to the manufacturer's specifications.
V. Have students mix and apply the polyurethane system while being observed by the instructor.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 25
Automotive Refinishing Principles and Techniques, Section VIII

TOOLS AND EQUIPMENT

Polyurethane color, polyurethane activator, reducer, spray gun, respirator

EVALUATION

The student will explain and/or demonstrate the procedure for using the polyurethane system according to the instructor's specifications and with 100% accuracy.

Suggested instructional time
2 class periods

DUTY: REFINISHING COMPLETE ENAMEL

TASK: Use flexible finish system

PERFORMANCE OBJECTIVE

Given the proper materials, the student must use the flexible finish system with 100% accuracy.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Explain the purpose of the flexible finish system.	
II. List and discuss the different manufacturers of the system.	
III. Describe the procedure for mixing and applying the flexible finish system.	
IV. Demonstrate mixing and applying the flexible finish system according to manufacturer's specifications.	IV. A. Listen and observe the instruction. B. Determine what materials will be needed to apply the flexible finish system. C. Mix and apply the flexible finish paint according to manufacturer's specifications.
V. Have students mix and apply the flexible finish system while being observed by the instructor.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 25

Automotive Refinishing Principles and Techniques, Section VIII

TOOLS AND EQUIPMENT

Acrylic lacquer paint, flexible finish additive, thinner, spray gun, respirator

EVALUATION

The student will explain and/or demonstrate the procedure for using the flexible finish system according to instructor's specifications and with 100% accuracy.

Suggested instructional time
15 class periods

DUTY: REFINISHING COMPLETE LACQUER

TASK: Refinish vehicle in acrylic lacquer

PERFORMANCE OBJECTIVE

Given a vehicle that needs painting and minor repairs, the student must make repairs and paint the vehicle using an acrylic lacquer paint and have it ready for delivery. The finished product must meet the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss refinishing with lacquer.	
II. Discuss how to test a car to find out what kind of paint is on it.	
III. Show the following filmstrips. Discuss them with the class. "Sand Techniques, Tools and Materials" (No. 941-21) "Masking, Priming, and Puttying" (No. 941-23) "Surface Prep for Painting" (No. 941-22) "Spraying Color on Vehicle" (No. 941-24) "Compounding and Polish" (No. 941-26)	
IV. Outline the steps and procedures for refinishing the vehicle using lacquer.	IV. A. Thoroughly clean the surface with detergent and water. B. Dry surface with clean rag. C. Wipe surface with a wax and grease remover solvent to remove all wax and grease. D. Repair minor damages. E. Sand off old paint at damage with coarse sandpaper. Featheredge smooth with 400 grit wet sandpaper.

F. When damaged area is properly prepared, wipe it thoroughly with a wax and grease remover, dry with clean dry rag, and treat bare metal with metal preparation.
G. Tack off with tack rag.
H. Spray prime the bare metal. Spot with primer surfacer.
I. Sand primer with 360 wet or dry sandpaper. Sand with 400 grit sandpaper.
J. Mask car.
K. Tack off vehicle with tack rag.
L. Mix paint properly.
M. Spray color on vehicle.
N. Allow vehicle to air dry overnight.
O. Buff and polish.

V. Explain the procedure for buffing and polishing.

RESOURCES

Automotive Refinishing Principles and Techniques, Sections VII and VIII
Filmstrips are from Prentice-Hall Media Center

TOOLS AND EQUIPMENT

Filmstrip projector, cassette tape player, screen, solvents, clean rags, disk sander, orbital sander, primer gun, primer surfacer, spray paint gun, paint, paint thinner, buffer, pads, compound, polish

EVALUATION

The student will make repairs and paint vehicle using acrylic lacquer paint. The finished product must meet the instructor's specifications.

Suggested instructional time
2 class periods

DUTY: REFINISHING COMPLETE LACQUER

TASK: Use colorcoat/clearcoat system

PERFORMANCE OBJECTIVE

Given the proper materials, the student must use the colorcoat/clearcoat system with 100% accuracy.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Explain the purpose of the colorcoat/clearcoat system.	
II. List and discuss the different manufacturers of the colorcoat/clearcoat system.	
III. Describe the procedure for mixing and applying the colorcoat/clearcoat system using lacquer.	
IV. Describe the procedure for mixing and applying the system using enamel.	
V. Demonstrate mixing and applying the colorcoat/clearcoat system according to the manufacturer's specifications.	V. A. Listen and observe the instruction. B. Determine what materials will be needed to apply the colorcoat/clearcoat system. C. Mix and apply the colorcoat/clearcoat paint according to the manufacturer's specifications.
VI. Have students mix and apply the colorcoat/clearcoat system while being observed by the instructor.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 25
Dupont. **Automotive Refinishing Principles and Techniques,** Section VIII

TOOLS AND EQUIPMENT

Colorcoat (lacquer or enamel), clearcoat (lacquer or enamel), thinner, reducer, spray gun, respirator

EVALUATION

The student will explain and/or demonstrate the procedure for using the colorcoat/clearcoat system according to the instructor's specifications and with 100% accuracy.

Suggested instructional time
4 class periods

DUTY: DETAILING (PAINTING AND REFINISHING)

TASK: Prepare newly painted vehicle for delivery (detailing)

PERFORMANCE OBJECTIVE

Given a refinished vehicle, the student must properly detail the vehicle so that it is ready for delivery to the customer. Detailing must meet the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Demonstrate the method for removing masking tape without damaging paint.	
II. Discuss types of cleaning materials to be used on the different parts.	
III. Demonstrate how to properly clean chrome without damaging paint.	
IV. Demonstrate cleaning paint fog (overspray) from glass.	
V. Demonstrate cleaning bumpers, tires, and wheels.	
VI. Demonstrate how to apply vinyl-top dressing.	
VII. Demonstrate how to vacuum interior and dash panel.	
VIII. Install stripes if necessary.	
IX. Have students complete the process for detailing the vehicle for delivery.	IX. A. Listen to the instruction on detailing. B. Remove masking tape and paper. C. Replace emblems, chrome, trim, etc. D. Clean all overspray from glass, chrome, interior, wheels, and tires.

E. Vacuum and clean interior and trunk.
F. Wash exterior body, tires, and trim and dry down.
G. Black out overspray under the wheel openings.

RESOURCES

Tolboldt. **Autobody Repair and Refinishing,** Unit 25
Crouse, Anglin. **Automotive Body Repair and Refinishing,** Chapter 38

TOOLS AND EQUIPMENT

Hand tool set, shop towels, polishing cloth, lacquer thinner, compound, polish, tire black

EVALUATION

The student will detail the refinished vehicle so that it is ready for delivery to the customer. Detailing must meet the instructor's specifications.

Suggested instructional time
2 class periods

DUTY: DETAILING (RELATED INSTRUCTION)

TASK: ALIGN HEAD LAMPS

PERFORMANCE OBJECTIVE

Given a vehicle requiring head lamp alignment, the student must aim head lamps to meet state safety standards.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the importance of aiming the head lamps.	
II. Explain the procedure for aligning the head lamps.	
III. Discuss the tools used to aim head lamps.	
IV. Demonstrate aiming the head lamps. Vehicle must be positioned on a level floor.	
V. Demonstrate how to remove and replace the head lamps.	V. A. Inspect vehicle for: 1. Sagged springs 2. Car riding height 3. Tire pressure 4. Clean head light lenses, etc. B. Select required tools. C. Remove head lamp doors, if necessary, for access to adjustment screws. D. Adjust head lamp to proper aim using necessary head light aiming equipment. E. Replace head lamp doors.

NOTE: There are other tasks which involve mechanical repair (i.e. cooling systems, steering, etc.) which have to be done when a car is damaged. These tasks would be listed under auto mechanics and can be added at the discretion of the auto body repair instructor.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Units 20 and 22

TOOLS AND EQUIPMENT

Star-shaped screwdriver, head light aiming kit, tire gauge, Phillips screwdriver, flat screwdriver

EVALUATION

On a vehicle requiring head lamp alignment, the student will aim head lamps to meet state safety standards.

Suggested instructional time
4 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Inspect body and frame and measure alignment

PERFORMANCE OBJECTIVE

Given a damaged vehicle requiring body and frame inspection, the student must set up the necessary frame gauge equipment, inspect, and tram to determine if the body openings and the frame are bent or misaligned. List the damage and then record, by each damaged measurement, the vehicle's true alignment specifications according to the manufacturer's manual or blueprint. Findings and measurements must be in agreement with the instructor's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Describe the different types of frames.	
III. Discuss and demonstrate the tools and instruments used in frame measuring.	
IV. Discuss and demonstrate tools and instruments used in checking body and opening damage.	
V. Compare measurements to manufacturer's specifications.	V. A. Inspect body and frame for apparent and hidden damage. B. Obtain manufacturer's blueprint and frame diagram specifications. C. Select proper measuring devices and tram equipment. D. Attach frame center gauges and datum line gauges to frame if needed. E. Determine damaged body openings and misalignments, if any. F. Record all damage requiring correction.

G. Beside each damaged measurement, record the manufacturer's blueprint specifications.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 16
Bottom View Auto Body and Frame, Dimension Charts
Straighten It the Simple Way — Kar Grabber: Operating Manual

TOOLS AND EQUIPMENT

Gauges (self-centering, datum line, tracking, tram), steel meauring tape, safety goggles

EVALUATION

The student will set up frame gauge equipment, inspect, and tram for bent frame or misalignment. The student will list the damages with corresponding true alignment specifications. Findings and measurements must be in agreement with those of the instructor.

Suggested instructional time
2 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Remove and replace bumpers

PERFORMANCE OBJECTIVE

Given a vehicle with a damaged front or rear bumper, the student must remove and install a replacement. Replacement will conform to the original appearance.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss damage to a given bumper, including brackets to frame and guards.	
III. Estimate damage with regard to straightening or replacement.	
IV. Discuss use of rechromed bumpers as opposed to new bumpers.	
V. Demonstrate adjusting brackets by using slotted holes.	V. A. Inspect damaged bumper. B. Select proper tools. C. Remove damaged bumper. D. Straighten or replace brackets as necessary. E. Install replacement bumper. F. Align and adjust bumper to body lines.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 14

TOOLS AND EQUIPMENT

Socket set, 1/2" and 3/8" drive, wrench set (open-end and combination), safety goggles

EVALUATION

The student will remove and install replacement (fixed) bumper. Replacement will conform to original appearance.

Suggested instructional time
2 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Remove and replace impact-absorbing bumpers

PERFORMANCE OBJECTIVE

Given a vehicle with impact-absorbing front or rear bumper damage, the student must remove damaged bumper and absorbers and install replacement parts. Replacement will conform to original appearance.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss the importance of safety connected with this type of bumper mounting system.	
III. Demonstrate the correct procedure for relieving pressure on hydraulic absorbers.	
IV. Demonstrate the replacement of the energy absorbing bolts and brackets on metal deformation units.	IV. A. Inspect bumper face bar and determine if the impact absorbers are the hydraulic or metal deformation type. B. Replace deformation mounting bars if they are bent. C. Replace hydraulic absorbers that are bent or binding in a compressed position. Drill and let fluid out before removing. D. Remove damaged bumper and parts. Replace as needed. E. Align to body as per specifications.
V. Demonstrate testing of absorbers.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 14

Manufacturer's shop manual as appropriate for equipment used and vehicle model

TOOLS AND EQUIPMENT

Safety goggles, 1/2" drive ratchet set, necessary sockets, hydraulic jack, jack stands, combination wrench set, drill and bits, chains

EVALUATION

The student will replace and align impact-absorbing bumpers or parts as necessary.

Suggested instructional time
4 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Remove and install fenders

PERFORMANCE OBJECTIVE

Given a vehicle requiring fender replacement, the student must remove, replace, and align replacement fender to original appearance (approximately 5/32" gap between door and hood).

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Demonstrate the importance of fender alignment.	
III. Discuss pro's and con's of repairing or replacing fender.	
IV. Inspect and discuss proper alignment of fender skirt and radiator cradle in relation to fender replacement.	
V. Discuss whether refinishing is necessary before or after installation of fender.	
VI. Demonstrate methods of attaching trim to new fender either before or after installation.	VI. A. Inspect damage. Check for related damage. B. Select hand tools. Decide on the method of replacing panel. C. Remove damaged fender. D. Check for hidden damage. E. Straighten and align inner fender or skirt. F. Transfer moldings and accessories. G. Install replacement fender. H. Adjust and align fender.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 20
Manufacturer's shop manual as appropriate for equipment used and vehicle model

TOOLS AND EQUIPMENT

Socket set (1/4" and 3/8" drive), open end and box end wrench set, Phillips and standard screw driver set, floor jack, safety stands, lug wrench, drill and necessary bits, safety goggles

EVALUATION

The student will remove, replace, and align replacement fender to original appearance. The fender will align to door, hood, and grill per specifications.

Suggested instructional time
8 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Straighten, repair and align body and frame of vehicle

PERFORMANCE OBJECTIVE

Given a vehicle with body and frame damage (i.e., sidesway, sag, mash, diamond, and twist), the student must straighten, align, and repair to original dimensions according to crash book or other shop manuals with manufacturer's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Review reading assignment.	
II. Determine which type frame needs straightening; conventional or unitized.	
III. Discuss where damage is located according to controlling points.	
IV. Diagnose the type and amount of damage using proper tools and gauges according to the manufacturer's specifications.	
V. Discuss and determine which type frame machine will be used for repairs.	
VI. Make necessary hook-ups and tie-downs and prepare to straighten damage.	VI. A. Inspect damage. B. Make necessary measurements to determine extent of damage to body and frame. C. Select proper tools, measuring devices, and equipment (i.e., portable or stationary body frame equipment). D. Make necessary tie-downs and hook-ups.

E. Straighten body and frame and align to manufacturer's specifications (**Motor Crash and Estimating Guide**, frame diagrams, and Tru-way frame specifications).

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 20
Straighten It the Simple Way — Kar Grabber: Operating Manual
Guy Chart: Complete Frame and Body Repair Equipment
Bottom View Auto Body and Frame, Dimension Charts

TOOLS AND EQUIPMENT

Necessary gauges, steel measuring tape, hydraulic jacks, chains, stationary racks, portable straightening equipment, stationary or portable frame machine, safety goggles

EVALUATION

The student will prepare an estimate of needed repairs and correct damage to meet manufacturer's specifications.

Suggested instructional time
4 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Align hood and deck panels

PERFORMANCE OBJECTIVE

Given a vehicle with misaligned hood or deck panel, the student must adjust hood or deck panel at adjustment points to insure alignment with adjacent panels (approximately 5/32" gaps between panels).

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss and demonstrate the different type of hinges used on hoods and deck panels.	
III. Discuss and demonstrate the types of latches and safety catches.	
IV. Demonstrate the proper procedure for correcting individual problems in alignment.	IV. A. Inspect misaligned hood or deck panel. B. Locate adjustment points. C. Select proper tools. D. Make adjustments necessary to secure alignment with adjacent panels.
V. Discuss procedures for adjusting torsion bar or rod adjustments.	
VI. Make necessary adjustments and measure for correct alignment.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 20
Manufacturer's shop manual as appropriate for equipment used and vehicle model

TOOLS AND EQUIPMENT

Ratchet set (3/8" drive), combination wrench set, manufacturer's special wrench for adjusting torsion bar, safety goggles

EVALUATION

The student will adjust hood or deck panel at adjustment points to insure alignment with adjacent panels.

Suggested instructional time
4 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Remove and install doors

PERFORMANCE OBJECTIVE

Given a vehicle requiring door replacement, the student must remove damaged door and install new replacement. Replacement door must be aligned to approximately a 5/32" gap between door and panels.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss the different methods used in hinge arrangements and adjustments on different make vehicles.	
III. Discuss different types of locking and striker plate arrangements.	
IV. Secure a vehicle needing door replacement.	
V. Obtain a new door to replace damaged door.	V. A. Inspect damaged door to determine proper selection of tools. B. Remove damaged door. C. Remove inside hardware and trim from damaged door. D. Remove door glass, regulators, and guides. E. Remove all door lock mechanisms. F. Remove outside door handle and lock cylinder. G. Remove all weather stripping. H. Install all hardware, weather stripping, trim, and accessories on new door shell.

I. Sound proof new door with undercoating.
J. Install and align new door.
K. Align and drill holes for trim molding.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 20

TOOLS AND EQUIPMENT

Socket set (3'8" drive), Phillips screwdriver set, standard screwdriver set, safety goggles, star-shaped socket set, inside door handle clip remover, Allen wrenches

EVALUATION

The student will remove damaged door and install new replacement. Replacement door must be aligned to approximately 5/32" gap between door and panels.

Suggested instructional time
5 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Weld vehicle body parts

PERFORMANCE OBJECTIVE

Given a vehicle requiring body panel installation (i.e., rocker panel, roof panel, quarter panel, etc.), the student must weld the panel to the adjacent parts. All steps on the instructor's checklist must be rated acceptable.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss different methods of welding panels together.	
III. Discuss how to section panels by cutting at different locations.	
IV. Demonstrate and explain how to align inner panel damage.	IV. A. Inspect vehicle to determine tools and equipment necessary for welding vehicle body parts. B. Obtain proper tools, welding equipment, and welding materials. C. Align adjacent parts to fit new panel tightly. D. Demonstrating proper techniques and safety practices, weld panel in place at required locations.
V. Demonstrate alignment points and space between adjacent panels.	
VI. Demonstrate sealing weld joints to prevent water and dust leaks.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, pp. 293-296

TOOLS AND EQUIPMENT

Safety goggles, panel to be replaced, power chisel, power saw, drill, pop rivets and gun, "C" clamps, vise grips, spot welder, oxyacetylene torch, MIG welder, steel tape measure, scratch awl

EVALUATION

The student will weld body panel to adjacent parts. All steps on the instructor's checklist must be rated acceptable.

INSTRUCTOR CHECKLIST: Weld vehicle body parts

ACTIVITY	Rating*	
	Acceptable	Unacceptable
1. Replacement panel is properly aligned.		
2. The spot welds to adjacent panels are approximately one (1) inch apart.		
3. Used proper welding material for strength.		
4. Joints are properly filed and finished.		
5. New panel conforms to the original contours of the body.		

*All activities must be checked acceptable.

Suggested instructional time
15 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Remove and install weld-in panel

PERFORMANCE OBJECTIVE

Given a vehicle requiring weld-in panel installation, the student must remove damaged panel and install replacement. Replacement panel must be aligned to conform to the original body contour.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the reading assignment.	
II. Discuss and evaluate the damaged panel to be replaced.	
III. Plan correct procedure to be used in aligning old panel and inner construction before cutting outer panel off.	
IV. Demonstrate different types of cuts that can be made to save time and still obtain perfect results.	
V. Attach frame aligning tools to panels and make pulls to align inner panels.	
VI. Demonstrate the procedure for removing damaged panel and installing replacement.	VI. A. Inspect panel for apparent and hidden damage. B. Select tools to pull or push damaged panel as near to original alignment as possible. C. Select proper cutting tools. 1. Air chisel 2. Torch 3. Power saw D. Remove upholstery and trim as necessary. E. Secure safety goggles and gloves. F. Using the proper cutting method, remove damaged panel.

G. Trim rough edges.
H. Attach replacement panel with clamps.
I. Properly align panel to adjacent body parts.
J. Grind and clean areas to be welded.
K. Spot weld as necessary.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 20

TOOLS AND EQUIPMENT

Socket sets (1/4", 3/8", 1/2" drive), safety goggles, grinders, welding equipment, spot welding gun (MIG or oxyacetylene), floor jack, frame jack, safety stands, drill and bits, seam sealer

EVALUATION

The student will remove damaged panel and install replacement. Replacement panel must be aligned to conform to the original body contour.

Suggested instructional time
10 class periods

DUTY: BODY AND FRAME ALIGNMENT

TASK: Replace fiberglass body panel

PERFORMANCE OBJECTIVE

Given a damaged vehicle requiring fiberglass panel replacement, the student must remove damaged fiberglass panel and install replacement panel. Finish sand the applied resin and fiberglass cloth to original contour.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Explain what safety equipment is needed when working with fiberglass.	
III. Demonstrate proper procedure for preparing replacement panel at joining point.	III. A. Inspect damage. B. Select proper tools, equipment, and materials. C. Select necessary safety equipment. (NOTE: Be sure to use this equipment as fiberglass, resins, and solvents can be very injurious to health if improperly used.) D. Remove damaged panel. E. Prepare replacement panel. 1. Sandblast or grind surfaces to be bonded. 2. Clean and dry surfaces to be bonded. F. Properly mix resin with catalyst according to supplier's instructions. G. Apply resin to bonding surfaces.

H. Secure replacement panel in place with "C" clamps or pop rivets.
I. Saturate fiberglass cloth in resin and apply to joint surface as needed.
J. Allow sufficient drying time.
K. Remove clamps and drill out pop rivets.
L. Grind and fill seams.
M. Smooth filled areas to original body contour.

IV. Demonstrate correct mixing procedure of ingredients.

V. Demonstrate how to apply matting and fiberglass and the smoothing procedure.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, pp. 356-359, 154-160

TOOLS AND EQUIPMENT

Safety goggles, fiberglass repair kit, clamps, pop rivets and gun, Squeegee or spreader, household plastic wrap, plastic filler, razor blades, hack saw or sabor saw, drill and drill bits, spatula, belt sander

EVALUATION

The student will remove damaged panel and install replacement panel on a damaged vehicle requiring fiberglass panel replacement. Finish sand the applied resin and fiberglass cloth to original contour.

Suggested instructional time
6 class periods

DUTY: WELDING: FRAMES OR FRAME HORNS

TASK: Weld frames or frame horns

PERFORMANCE OBJECTIVE

Given a vehicle with a damaged frame section or a frame horn requiring a welded replacement part, the student must arc weld and align the frame. Weld and alignment must restore vehicle to original dimensions according to crash book or other shop manuals with manufacturer's specifications.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Explain the importance of proper alignment of frame and frame horns.	
II. Explain and show parts which need to be removed and replaced in order to accomplish repair.	
III. Demonstrate how to measure for alignment of frames.	III. A. Inspect frame damage. B. Select tools and equipment. C. Remove sheet metal necessary for access. D. Weld any cracks or tears; align frame to manufacturer's specifications. E. Remove by cutting damaged frame horn or frame section. F. Cut replacement piece to fit. G. Grind and clean areas to be welded. H. Clamp in place. I. Weld in place using correct equipment and technique. J. Replace sheet metal removed for access. K. Refinish frame section repair. L. Align front end.

IV. Caution students to measure for accuracy in aligning frames before welding.
V. Explain how the body would reflect misalignment in the hood, front fender to door, and rear end trunk and bumpers to body.

RESOURCES

Shop manual or crash book

TOOLS AND EQUIPMENT

Gas welding torch, electric arc welder, safety goggles, welding hood or helmet, welding goggles and gloves, electrodes, flint lighter, tram gauge, tape measure, frame machine

EVALUATION

The student will arc weld and align the damaged frame section or frame horn. Weld and alignment must restore vehicle to original dimensions according to crash book or other shop manuals with manufacturer's specifications.

V-TECS 49

Suggested instructional time
2 class periods

DUTY: REPAIR, REPLACE, ADJUST, AND INSTALL TRIM AND ACCESSORIES

TASK: Remove and replace grills

PERFORMANCE OBJECTIVE

Given a vehicle with grill damage, the student must remove and replace grill. Replacement will conform to original appearance.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Determine (with explanation) the material that makes up the grill.	
III. Determine the method used for attaching grill.	
IV. Discuss the make up of grills on units in shop area and different methods of attachment.	
V. Have students remove and replace grills.	V. A. Inspect damaged grill. B. Select proper tools. C. Remove damaged grill. D. Straighten necessary brackets or mountings. E. Install grill. F. Align for fit.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Units 16 and 20
Duenk, Williams, and Brooks. **Auto Body Repair,** p. 139
Manufacturer's body manual as appropriate for equipment and vehicle model

TOOLS AND EQUIPMENT

Standard and Phillips screw drivers, 1/4" drive ratchet socket set, combination wrench set, safety goggles, star screwdriver set

EVALUATION

The student will identify grill material and attaching method, and remove, replace, and align grills on assigned unit. Replacement will conform to original appearance.

Suggested instructional time
2 class periods

DUTY: REPAIR, REPLACE, ADJUST, AND INSTALL TRIM AND ACCESSORIES

TASK: Replace molding and hardware

PERFORMANCE OBJECTIVE

Given a vehicle requiring molding or hardware replacement, the student must remove and replace damaged molding or hardware. Replacements must conform to the original appearance and function.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss different types of molding attachment methods.	
III. Demonstrate correct use of different attaching clips.	
IV. Demonstrate method of measuring and drilling holes when using new, undrilled panels.	
V. Have each student work on a unit by removing and replacing the different retainers and moldings on the different panels.	V. A. Inspect vehicle to determine necessary tools. B. Remove hardware and upholstery if necessary for access. C. Locate clips and fasteners securing molding. D. Remove damaged molding. E. Install clips and fasteners as required to replacement molding. F. Install replacement molding. G. Install hardware and upholstery.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 22
Duenk, Williams, and Brooks. **Auto Body Repair**, pp. 254-260
Manufacturer's body manual as appropriate for the equipment and vehicle model

TOOLS AND EQUIPMENT

Safety goggles, 1/4" drill, drill bit set, standard and Phillips screw driver sets, 1/4" drive ratchet socket set, any other special tools required for vehicles used for demonstration model

EVALUATION

The student will remove and replace damaged molding or hardware. Replacements must conform to the original appearance and function.

Suggested instructional time
4 class periods

DUTY: REPAIR, REPLACE, ADJUST, AND INSTALL TRIM AND ACCESSORIES

TASK: Replace locks and latches

PERFORMANCE OBJECTIVE

Given a vehicle requiring replacement of latch-lock mechanism, the student must remove damaged or worn latch-lock mechanism and replace with new replacement part.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss the different ways inside trim pads are attached on different makes and models of vehicles and their removal.	
III. Discuss and demonstrate the removal of latch-lock mechanisms.	
IV. Demonstrate the adjustment of striker plate in relation to poor alignment.	
V. Demonstrate installation of weather-water shield before installing trim pad.	V. A. Select tools. B. Remove trim and upholstery if necessary to gain access to latch-lock mechanism. C. Disconnect activating arms and remove latch-lock mechanism. D. Install replacement latch-lock mechanism. E. Adjust door lock striker mechanism if necessary. F. Make operational check on mechanisms. G. Replace trim and upholstery.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 22
Duenk, Williams, and Brooks. **Auto Body Repair**, pp. 221-230
Manufacturer's shop manual as appropriate for equipment and vehicle model

TOOLS AND EQUIPMENT

Cut-away models of at least two different makes of vehicles, standard and Phillips screwdriver sets, 1/4" drive ratchet set, special manufacturer's tools necessary for removal of trim pad, Allen wrench (for adjusting striker plate), safety goggles

EVALUATION

The student will demonstrate how to remove, replace, and adjust latch-lock assembly on different vehicles as per availability.

Suggested instructional time
4 class periods

DUTY: REPAIR, REPLACE, ADJUST, AND INSTALL TRIM AND ACCESSORIES

TASK: Repair or replace window raising and lowering mechanisms

PERFORMANCE OBJECTIVE

Given a vehicle with damaged or broken window mechanism, the student must repair or replace as necessary. Repaired mechanism must raise and lower smoothly.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss possible damage from a wrecked auto and the necessary repairs.	
III. Discuss and demonstrate replacement and alignment of different parts of mechanism using cut-away model.	
IV. Demonstrate possible repairs to manual regulator assemblies and aligning guides.	
V. Install regulator and align to raise and lower evenly.	V. A. Inspect damaged areas. B. Select proper tools. C. Remove door trim and hardware for access. D. Replace or repair damaged parts. E. Insure proper alignment before replacing door trim. F. Replace door trim.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 22
Duenk, Williams, and Brooks. **Auto Body Repair**, pp. 213-220
Manufacturer's shop manual as appropriate for equipment and vehicle model

TOOLS AND EQUIPMENT

Cut away models of at least two different makes of vehicles, standard and Phillips screwdriver set, 1/4" drive ratchet set, special manufacturer's tools for trim removal, safety goggles

EVALUATION

The student will demonstrate how to repair or replace a damaged or broken window mechanism. Repaired mechanism must raise and lower smoothly.

Suggested instructional time
6 class periods

DUTY: REPAIR, REPLACE, ADJUST, AND INSTALL TRIM AND ACCESSORIES

TASK: Remove, replace, and adjust power window control units

PERFORMANCE OBJECTIVE

Given a vehicle with defective power window control units, the student must make necessary replacement or repair. Repaired window must operate as the original.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss and demonstrate different regulator and motor attaching methods.	
III. Demonstrate methods of trouble shooting wire harness at cowl to door.	
IV. Demonstrate the procedure for replacing defective power window control unit.	IV. A. Inspect vehicle and determine tools needed. B. Remove inside door hardware and upholstery. C. Remove access panels if necessary. D. Trouble shoot power window control switch and motor. E. Inspect wires for any damage or short circuits. F. Unplug and remove faulty unit. G. Install replacement unit. H. Make operational check and adjust as necessary. I. Install access panel and upholstery. J. Check wiring color code.

V. Demonstrate different methods for testing switches and motors for power or shorts.

VI. Discuss and demonstrate procedures for aligning glasses to run channel in doors, or weatherstrip in door openings.

VII. Discuss and demonstrate methods and safety involved in replacing power motors.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 22
Manufacturer's shop manual

TOOLS AND EQUIPMENT

Cut-away of door showing regulator and adjustments, inside door handle clip remover, 12-volt test light, trim pad removing tool, drill and necessary bits, Phillips screwdriver #1 and 2, socket set (1/4" drive), safety goggles

EVALUATION

The student will make necessary replacement or repair to defective power window control units. Repaired window must operate as the original.

Suggested instructional time
6 class periods

DUTY: REPAIR, REPLACE, ADJUST, AND INSTALL TRIM AND ACCESSORIES

TASK: Repair power window control units

PERFORMANCE OBJECTIVE

Given a vehicle with faulty power window, the student must remove necessary upholstery, trouble shoot, and make necessary repair or replacement. Repaired window must operate as the original.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss and demonstrate different regulator and motor attaching methods.	
III. Demonstrate methods of trouble shooting wire harness at cowl to door.	
IV. Demonstrate the procedure in repairing power window control units.	IV. A. Inspect vehicle to determine tools and equipment. B. Remove door upholstery and access panels. C. Trouble shoot activating switch. D. Trouble shoot power window control motor. E. Make necessary repair or replacement of switch, motor, and regulator. F. Check for correct operation. G. Install door upholstery.
V. Demonstrate different methods for testing switches and motors for power or shorts.	
VI. Discuss and demonstrate methods involved in repairing power motors.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 22
Manufacturer's shop manual

TOOLS AND EQUIPMENT

Cut-away of door showing regulator and adjustments, inside door handle clip remover, 12-volt test light, trim pad removing tool, drill and necessary bits, Phillips screwdriver #1 and 2, socket set (1/4" drive), safety goggles

EVALUATION

The student will make necessary repair or replacement to a vehicle with a faulty power window. Repaired window must operate as the original.

Suggested instructional time
2 class periods

DUTY: REPAIR, REPLACE, ADJUST, AND INSTALL TRIM AND ACCESSORIES

TASK: Repair manual seat tracks

PERFORMANCE OBJECTIVE

Given a vehicle requiring manual seat track repair, the student must make necessary repairs or replacement, install seat, and check for correct operation. Seat must operate smoothly and lock in all positions.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment on seats.	
II. Explain how to check for damage.	II. A. Acquire necessary tools. B. Remove seat from vehicle. C. Inspect and determine faulty mechanism. D. Make necessary repairs or replacements. E. Lubricate all tracks and operating mechanism. F. Install seat in vehicle. G. Check seat operation.
III. Demonstrate how to remove the seat.	
IV. Demonstrate how to remove seat track.	
V. Discuss the tools needed.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 22

TOOLS AND EQUIPMENT

Small ratchet and socket kit

EVALUATION

The student will remove front seat and make necessary repair or replacement of seat tracks. Install seat in car and check for operation.

V-TECS 48

Suggested instructional time
2 class periods

DUTY: REPAIR, REPLACE, ADJUST, AND INSTALL TRIM AND ACCESSORIES

TASK: Remove and replace seat and shoulder belts

PERFORMANCE OBJECTIVE

Given a vehicle requiring seat belt and shoulder harness replacement, the student must remove defective or worn belts and harness and replace with replacement units. Replacement belts must meet or exceed original installation.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss the removal of front and rear seats.	
II. Discuss the removal of shoulder straps or belts.	II. A. Inspect seat belts and shoulder harness. B. Select proper tools. C. Remove retainer bolts from belts and shoulder harness and remove worn or defective belts. D. Install replacement belts.
III. Discuss how belts are anchored and points where they are anchored.	
IV. Describe the types of belt retractors.	
V. Discuss the types of seats (bucket and bench).	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 22
Duenk, Williams, and Brooks. **Auto Body Repair,** pp. 199-200

TOOLS AND EQUIPMENT

Mechanic's tool set

EVALUATION

The student will remove defective seat belt and shoulder harness units and replace the units to meet the manufacturer's specifications.

Suggested instructional time
4 class periods

DUTY: REMOVING AND INSTALLING GLASS

TASK: Adjust or align windows in doors

PERFORMANCE OBJECTIVE

Given a vehicle door with glass requiring adjustment or alignment, the student must adjust or align window. Alignment must prevent wind noise, water leaks, and rattles.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Review and discuss reading assignment.	
II. Discuss and demonstrate the methods for aligning glass.	
III. Demonstrate and explain the difference in aligning glass with a frame and without.	
IV. Have each student remove and replace trim and explain the procedure for aligning glass.	
V. Demonstrate how to test aligned glass for water and air leaks.	V. A. Select proper tools. B. Remove inside door hardware and trim. C. Locate adjustment points. D. Align window to prevent: 1. Wind noise 2. Water leaks 3. Rattle E. Test for water leaks. F. Replace inside door hardware and trim.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Chapters 9 and 23
Manufacturer's shop manual

TOOLS AND EQUIPMENT

Inside door handle clip remover, trim pad removing tool, Phillips screwdriver set, socket set (1/4" drive), combination wrench set, safety goggles, cut away of door showing regulator and adjustments

EVALUATION

The student will adjust or align the window on a vehicle door. Alignment must prevent wind noise, water leaks, and rattles.

V-TECS 52

Suggested instructional time
5 class periods

DUTY: REMOVING AND INSTALLING GLASS

TASK: Remove damaged glass and install replacement

PERFORMANCE OBJECTIVE

Given a vehicle with a broken glass, the student must remove broken glass and install replacement. Replacement glass must equal the original in function and appearance.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Review reading assignment.	
II. Discuss different methods of attaching glass to lifting channels.	
III. Using cut away, demonstrate removal of broken glass and retaining channel.	
IV. Demonstrate attaching new glass to retaining channel.	IV. A. Inspect damage. B. Select proper tools and equipment. C. Remove broken glass from inside vehicle. D. Remove inside trim as necessary. E. Remove access panels as necessary. F. Remove broken glass. G. Remove window regulator and tracks as necessary. H. Repair or replace damaged channels if necessary. I. Install replacement glass and attach to regulator and tracks. J. Check for ease of operation and correct alignment. Lubricate as necessary. K. Replace access panels and upholstery.

V. Reinstall glass and channel.
Check for alignment, correcting any misalignment.

RESOURCES

Rhone and Yates. **Total Auto Body Repair**, Unit 23
Manufacturer's shop manual

TOOLS AND EQUIPMENT

Inside door handle clip remover, trim pad removing tool, Phillips screwdriver set, Allen wrench set, socket set (1/4" drive), combination wrench set, glass tape, vise, safety goggles, hammer, cut away of door showing regulators and adjustments

EVALUATION

The student will remove broken glass and install replacement on a given vehicle. Replacement glass must equal the original in function and appearance.

Suggested instructional time
2 class periods

DUTY: REMOVING AND INSTALLING GLASS

TASK: Seal leaks around windshield and rear window

PERFORMANCE OBJECTIVE

Given a vehicle with a leaky seal around the windshield or rear window, the student must seal discovered leaks as required. Finished work will not leak under water pressure.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Explain and demonstrate method of removing reveal moldings.	
III. Inspect sealer around glass for possible leaks. Blow out trash with air nozzle.	
IV. Demonstrate water testing from bottom to top.	IV. A. Use water to determine the exact place of leak. B. Select proper tools and materials. C. Remove reveal molding if necessary. D. Seal as required. E. Check by water test. F. Replace molding. G. Clean and remove excess sealer.
V. Demonstrate the method for sealing and use of the proper sealer or caulking to stop the leak.	

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 9
Application Guide for Automotive Adhesives, Coatings, Sealers

TOOLS AND EQUIPMENT

Reveal molding removing tools, putty knife, wooden paddles, regular screwdrivers, water hose and water, necessary sealers and caulking, Phillips screwdrivers, caulking gun, safety goggles

EVALUATION

The student will discover leaks and seal as required. Finished work will not leak under water pressure.

Suggested instructional time
6 class periods

DUTY: REMOVING AND INSTALLING GLASS

TASK: Remove and replace damaged windshield and back glass

PERFORMANCE OBJECTIVE

Given a vehicle with a damaged windshield or back glass, the student must remove damaged glass and install replacement. Replacement glass must equal the original in function and appearance.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Explain and demonstrate different types of clips used for attaching reveal moldings.	
III. Discuss different ways and materials used for installing windshield and back glasses.	III. A. Inspect damage. B. Select proper tools and materials. C. Remove broken glass from inside of vehicle. D. Remove reveal moldings and garnish moldings as necessary. E. Remove broken glass from body opening. F. Remove old sealer. G. Replace glass and seal. H. Water test for leaks. I. Replace all moldings.
IV. Demonstrate different methods and tools to cut butyl rubber.	
V. Demonstrate methods of removing and replacing weatherstrip-type rubber channel.	

RESOURCES

Rhone and Yates. **Auto Body Repair**, Unit 23
Application Guide for Automotive Adhesives, Coatings, Sealers

TOOLS AND EQUIPMENT

Reveal molding removing tools, putty knife, standard and Phillips screwdrivers, water hose and water, Butyl rubber seal, window resealant, goggles, piano wire, swiv-l-cut knife, hot knife

EVALUATION

The student will remove damaged glass and install replacement. Replacement glass must equal the original in function and appearance.

V-TECS 54

Suggested instructional time
4 class periods

DUTY: COST ESTIMATING

TASK: Estimate cost of repairs

PERFORMANCE OBJECTIVE

Given a damaged vehicle requiring a cost estimate, the student must estimate and record the cost of vehicle repair. Cost estimate must be a plus or minus (+ or -) 10% of the instructor's estimate.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Discuss reading assignment.	
II. Discuss the importance of making an accurate estimate.	
III. Show and discuss filmstrip "Estimating Body Damage."	
IV. Explain the procedure for converting hours of labor to dollars by rates per hour.	IV. A. Secure clipboard and proper estimating sheet. B. Select proper estimating price and parts manual. C. Make thorough inspection of damage. D. List damaged parts to be replaced or straightened in their proper sequence. E. Price parts and labor from estimating manuals. F. Total parts and labor and add sales tax. G. Return estimate to the instructor for evaluation.
V. Divide the class into small groups to estimate the repair work needed for a given vehicle.	

VI. Estimate repair costs of damaged vehicle units at a local repair shop and compare them with professional estimates.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 2
Duenk, Williams, and Brookes. **Auto Body Repair,** pp. 391-396
Mitchell's Collision Repair Manual
Motor Crash Estimating Guide
National Auto Dealers Used Car Guide (NADA)

TOOLS AND EQUIPMENT

Clipboard, estimate blanks, part and labor manuals, carbon paper, hour/labor conversion table, used car price guide

EVALUATION

The student will estimate the cost to repair damaged vehicle and compare it with instructor's estimate, plus or minus (+ or -) 10%.

Suggested instructional time
6 class periods

DUTY: RELATED INSTRUCTION

TASK: Managing the shop

PERFORMANCE OBJECTIVE

Upon completion of an assigned managerial task, the student must demonstrate his/her proficiency by passing an instructor's checklist.

LEARNING ACTIVITIES

I. Discuss the techniques used in selling the repair job to the customer.

II. Set up and discuss work displays.

III. Explain how to point out needed work to a customer.

IV. Have each student take turns managing the shop.

V. Discuss communication skills in dealing with employees.

PERFORMANCE GUIDE

A. Learn what is expected for each managerial task by reading the checklist.
B. Learn to make work assignments.
C. Help instructor mediate conflicts.
D. Regulate distribution and care of materials and equipment.
E. Supervise safety and clean up procedures.
F. Help other students meet curriculum objectives.
G. Learn to be responsible.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 3
Duenk, Williams, and Brooks. **Auto Body Repair,** pp. 385-390

TOOLS AND EQUIPMENT

N/A

EVALUATION

The student will demonstrate his/her proficiency by passing an instructor's checklist and completing an assigned managerial task.

Suggested instructional time
4 class periods

DUTY: RELATED INSTRUCTION

TASK: Writing work orders

PERFORMANCE OBJECTIVE

Given classroom instruction, reading assignment, and role-playing activities, the student will be able to write a work order with the necessary information to repair a damaged vehicle with 100% accuracy.

LEARNING ACTIVITIES	PERFORMANCE GUIDE
I. Demonstrate how to write a work order using a teacher-developed checklist.	
II. Show how to list each job to be done separately on the work order.	
III. Explain how to compute the price of the work and the fact that it is done while the customer waits.	
IV. Explain how to read shop manuals.	
V. Distribute labor conversion tables and explain how to read them.	
VI. Have the students to role play the parts of customer and repairer in pointing out the work and writing the work order.	VI. A. Greet the customer with a pleasant attitude. B. Visually assess the damage and let the customer explain the damage. C. Place the vehicle in a position where a more complete inspection is possible. D. Using the checklist, itemize the work needed with an estimate of the cost and time.

E. Explain the necessary repair work to the customer, the cost, and the time required to complete the work.
F. Upon consent from the customer, schedule the repair work.

RESOURCES

Rhone and Yates. **Total Auto Body Repair,** Unit 3

TOOLS AND EQUIPMENT

N/A

EVALUATION

The student will write a work order with the necessary information to repair a damaged vehicle with 100% accuracy.

APPENDIX A
AUTO BODY REPAIR

DUTIES AND TASKS

Duty/Task	Performance Objective	Page Number
I. INTRODUCTION TO AUTO BODY REPAIR		
Describe objectives of course in auto body repair	SC-1	6
List occupational elements of auto body repairer	V-TECS 1	7
II. SAFETY		
Demonstrate knowledge of first aid and safety	V-TECS 2	10
III. TOOLS		
Using hand tools	V-TECS 4	22
Using power tools	V-TECS 5	24
IV. AUTO BODY CONSTRUCTION		
Name the parts of auto body construction	V-TECS 3	27
Identify unitized-body measurement of damaged vehicle	SC-2	29
Describe frame and unitized construction	SC-3	31
Realign a unitized body	SC-4	32
V. METAL STRAIGHTENING, SIMPLE		
Pick, file, and finish metal	V-TECS 8	35
Straighten deformed auto body sheet metal	V-TECS 9	37
Fill and smooth depressed areas with body filler	V-TECS 10	39
Cold shrinking metal	V-TECS 32	41
Patching and filling rusted out areas	SC-5	43
Repair fiberglass	V-TECS 11	45
VI. WELDING		
Setting up oxyacetylene equipment	V-TECS 21	48
Adjusting the oxyacetylene torch and observing the various flames	V-TECS 23	51
Turning off the torch and oxyacetylene unit	V-TECS 22	53
Running a bead without filler rods	V-TECS 24	55
Running a bead with filler rods	V-TECS 25	57
Welding joints	V-TECS 26	59
Brazing with brass rods	V-TECS 27	62
Setting up equipment for oxyacetylene cutting	V-TECS 28	65

Lighting and adjusting the torch for oxyacetylene cutting	V-TECS 29	68
Oxyacetylene cutting (90° cut and restart cut)	V-TECS 30A	71
Oxyacetylene cutting (beveled cut and hole cut)	V-TECS 30B	73
Heat shrinking metal	V-TECS 31	76
Set up electric welding equipment and run a bead	SC-6	78
Set up MIG welding equipment and run a bead	SC-7	80
Run a bead on aluminum in the horizontal position	SC-8	82
Set up thermoplastic welding equipment and run a bead	SC-9	84

VII. PAINTING AND REFINISHING

Describe refinishing materials and equipment	SC-10	87
Clean and prepare repaired surfaces for painting	V-TECS 12	88
Remove paint and rust	V-TECS 13	90
Apply corrosion materials	V-TECS 14	91
Mask sections and parts	V-TECS 15	93
Apply primer surfacer	V-TECS 16	94
Paint surfaces	V-TECS 17	96
Heat dry painted surface	V-TECS 18	98
Fresh painted surfaces	V-TECS 19	99

VIII. REFINISHING COMPLETE ENAMEL

Refinish vehicle in enamel paint	SC-11	102
Use acrylic enamel system	SC-12	104
Use polyurethane system	SC-13	105
Use flexible finish system	SC-14	106

IX. REFINISHING COMPLETE LACQUER

Refinish vehicle in acrylic lacquer	SC-15	108
Use colorcoat/clearcoat system	SC-16	110

X. DETAILING

Prepare newly painted vehicle for delivery	V-TECS 20	113
Align head lamps	V-TECS 7	115

XI. BODY AND FRAME ALIGNMENT

Inspect body and frame and measure alignment	V-TECS 34	118
Remove and replace bumpers	V-TECS 36	120
Remove and replace impact-absorbing bumpers	SC-17	121
Remove and install fenders	V-TECS 37	123

Straighten, repair, and align body and frame of vehicle V-TECS 38 125
Align hood and deck panels V-TECS 35 127
Remove and install doors V-TECS 39 129
Weld vehicle body parts V-TECS 40 131
Remove and install weld-in panel V-TECS 41 134
Replace fiberglass body panel V-TECS 42 136

XII. WELDING: FRAMES OR FRAME HORNS

Weld frames or frame horns V-TECS 33 139

XIII. REPAIR, REPLACE, ADJUST, AND INSTALL TRIM AND ACCESSORIES

Remove and replace grills V-TECS 49 142
Replace molding and hardware V-TECS 50 143
Replace locks and latches V-TECS 43 145
Repair or replace window raising and lowering mechanisms V-TECS 44 147
Remove, replace, and adjust power window control units V-TECS 45 149
Repair power window control units V-TECS 46 151
Repair manual seat tracks V-TECS 47 153
Remove and replace seat and shoulder belts V-TECS 48 154

XIV. REMOVING AND INSTALLING GLASS

Adjust or align windows in doors V-TECS 51 156
Remove damaged glass and install replacement V-TECS 52 158
Seal leaks around windshield and rear window V-TECS 53 160
Remove and replace damaged windshield and back glass SC-18 162

XV. COST ESTIMATING

Estimate cost of repairs V-TECS 54 165

XVI. RELATED INSTRUCTION

Managing the shop V-TECS 6 168
Writing work orders SC-19 170

APPENDIX B
DEFINITION OF TERMS

The following terms are supplied to establish operational definitions as they apply to this study.

CAREER LADDER: A vertical arrangement of jobs within an occupational area to indicate skill distinction and progression.

CATALOGS: A comprehensive collection of performance objectives, performance guides, criterion-referenced measures, and related data organized by a job structure or career ladder within a domain of interest.

CONSORTIUM: A group of state agencies, institutions, or other entities which have been legally constituted through letters of commitment, agreements, or by assignment of higher authorities to work together toward the solution of problems in education. A membership from autonomous agencies and institutions which cuts across state boundaries as they attempt to solve problems or meet goals.

D.O.T. CODE: A nine-digit number used to identify a specific job within a given domain.

INSTRUCTIONAL SYSTEM DEVELOPMENT (ISD): A deliberate, orderly process for planning and developing instructional programs which insures that personnel are taught the knowledge, skills, and attitudes essential for successful job performance. Depends on a description and analysis of the tasks necessary for performing the job, objectives, evaluation procedures to determine whether or not the objectives have been reached, and methods for revising the process based on empirical data.

OCCUPATIONAL INVENTORY (TASK INVENTORY BOOKLET): A survey instrument containing tasks performed by job incumbents within D.O.T.'s complete with background information and a list of tools and equipment.

PERFORMANCE-BASED INSTRUCTION: Instruction which, when properly designed and applied, results in the learner's demonstration of certain abilities. The desired abilities are selected before the instruction is designed and are clearly defined as observable performance objectives. In V-TECS catalogs, the abilities are primarily psychomotor. This type of instruction is also referred to as competency-based instruction.

PERFORMANCE GUIDE (PG): A series of steps, arranged in a sequence ordinarily followed, which when completed may result in the performance of a task. Also, called "teaching steps."

PROJECT: An occupational domain area selected by a V-TECS member state for catalog development based upon the U.S. Department of Labor's Dictionary of Occupational Titles (D.O.T.).

STATE-OF-THE-ART (SOA STUDY): Research conducted to determine the current status of performance-based instructional materials and practices in the domain area under study and to obtain other information that might be useful in catalog development.

TASK: A unit of work activity which constitutes logical and necessary steps in the performance of a duty. A task has a definite beginning and ending point in its accomplishments and generally consists of two or more definite steps.

TASK ANALYSIS: A characteristic of a task statement which makes its accomplishments crucial to the acceptable performance of a worker or student. A method of analysis which identifies the critical tasks and aids in determining the consequence of poor performance or lack of performance by a worker or student.

WRITING TEAM: A team of people representing instructors with subject matter expertise, persons having knowledge and experience in developing criterion-referenced measures, local or state supervisors of incumbent workers whose function is to analyze occupational data and develop performance objectives and criterion-referenced measures for specific D.O.T. areas.

APPENDIX C
TOOL AND EQUIPMENT LIST

Equipment by Percentage Rating and Number of Members Using*

EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	PERCENTAGE OF MEMBERS USING	NUMBER OF MEMBERS USING
36	Extension Cord	93.68	163
2	Air Compressor	91.95	160
5	Air Hose, with Quick Couplings	90.80	158
97	Socket Sets, 1/4", 3/8", 1/2"	90.80	158
92	Screwdrivers, Phillips	90.23	157
26	Creepers	89.08	155
93	Screwdrivers, Standard	89.08	155
12	Automotive Disc Sanders (Grinder)	88.51	154
34	Drop Lights	87.93	153
127	Wrenches, Combination Set	87.93	153
33	Drill Bits, Set	87.36	152
81	Putty Knife	87.36	152
43	Hammers, Body	86.78	151
17	Body Files, Flat and Half-Round	86.21	150
21	Caulking Gun	86.21	150
42	Hacksaw	86.21	150
96	Socket Adapters	86.21	150
126	Wrenches, Box Set	86.21	150
9	Allen Wrenches, Set	85.63	149
128	Wrenches, Open-End Set	85.63	149
52	Jacks, Floor Roller	85.06	148
6	Air Regulator, with Extractors	84.48	147
71	Pliers, Assorted	84.48	147
89	Sanding Blocks	84.48	147
14	Body Clamps, Assorted	83.91	146
70	Plastic Spreaders	83.91	146
87	Safety Goggles	83.91	146
4	Air File, Orbital or Straight Line	82.76	144
19	Brushes, Wire	82.76	144
24	Come-Along	82.76	144
45	Hammer, Sledge	82.76	144
116	Tools, Door Handle Clip Removing	82.76	144
121	Vise	82.76	144
56	Jumper Cables	82.18	143
13	Battery Charger	81.61	142
31	Dollies, Assorted	81.61	142
75	Pop-Rivet Tool	81.61	142

*V-TECS Catalog

EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	PERCENTAGE OF MEMBERS USING	NUMBER OF MEMBERS USING
122	Vise Grip Clamps, Assorted	81.61	142
15	Body and Fender Jacks, 4-Ton Capacity	81.03	141
74	Pliers, Vise Grip	81.03	141
95	Slide Hammer (Snatch Bar)	81.03	141
23	Chisels, Assorted	80.46	140
65	Oxyacetylene Welder	80.46	140
78	Pull Clamps	79.89	139
80	Punches, Assorted	79.89	139
67	Panel Cutter Set, Air Drive	79.31	138
105	Spray Gun, for Primer	78.16	136
55	Jitterbug, Orbital	77.59	135
38	File Boards	77.01	134
63	Measuring Tape	76.44	133
3	Air Drill	75.86	132
35	Electric Drill	75.86	132
115	Tools, Door Handle Pin Removing	75.86	132
48	Helmet, Welding	74.71	130
27	Cutter, Sheet Metal, Hand	74.14	129
76	Portable Frame Machine (Pulldozer)	74.14	129
20	Bumper Chains	72.41	126
61	Mallet, Rubber	72.41	126
123	Wheel Covers	72.41	126
125	Wrench, Air Drive, 3/8"	72.41	126
29	D.A. Sander (Random Orbital)	71.84	125
107	Stands, Adjustable	71.84	125
1	Air Chuck, for Air Tires	70.11	122
28	Cutter, Sheet Metal, Power	70.11	122
50	Hole Saw	70.11	122
124	Wrench, Air Drive, 1/2"	68.39	119
11	Arc Welder	67.82	118
39	Files, Special Purpose	67.82	118
62	Masking Machine	67.24	117
69	Picks, Assorted	67.24	117
98	Soldering Kit (Gun or Iron)	67.24	117
16	Body and Fender Jacks, 10-Ton Capacity	65.52	114
64	Oiler	65.52	114
91	Screwdrivers, Clutch	65.52	114
77	Power Polisher	64.94	113
25	Crash Book	63.79	111
41	Gun, Air Dusting	62.64	109
57	Magnetic Pick-Up Tools	61.49	107
104	Spray Gun, Enamel Nozzle	61.49	107
30	Disc Cutter	60.92	106
32	Drain Pans	60.92	106
114	Test Light, Circuit	60.92	106

EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	PERCENTAGE OF MEMBERS USING	NUMBER OF MEMBERS USING
106	Spray Gun, Lacquer Nozzle	60.34	105
53	Jacks, Mechanical	56.90	99
103	Spray Gun, Detail	56.90	99
86	Respirator	55.17	96
79	Pull Straps, Fender	54.02	94
100	Spoons, Assorted	54.02	94
40	Grinder, Bench	53.45	93
88	Sandblast Gun	52.30	91
90	Scratch Awl (Scribe)	52.30	91
37	Fender Covers	51.72	90
94	Screw Extractor Set (Easy Out)	51.15	89
112	Tap and Die Set, Standard	50.57	88
119	Tubing Flaring Set	50.57	88
46	Headlight Aiming Kit	48.28	84
108	Staple Gun	48.28	84
111	Steel Work Benches	48.28	84
72	Pliers, Drip Molding	46.55	81
18	Brushes, Striping	45.98	80
44	Hammers, Machine	43.68	76
68	Panel Vacuum Lift (Suction Cup)	43.68	76
73	Pliers, Hog Ring	43.10	75
47	Heat Gun	41.95	73
22	Center Line Gauge	40.80	71
117	Tram Gauge	39.08	68
7	Air Regulator, without Extractors	35.63	62
109	Stationary Frame Machine	35.63	62
66	Paint Shaker	35.06	61
118	Tram Rod	35.06	61
101	Spot Welding Gun, Rod	33.33	58
120	Vinyl Top Repair Kit	29.89	52
60	Mallet, Plastic	29.31	51
99	Solder Paddles, Curved or Flat	29.31	51
51	Infra-Red Paint Dryer	28.74	50
49	Hoist, Chain or Pneumatic	27.01	47
113	Tap and Die Set, Metric	23.56	41
58	Mallet, Brass	22.99	40
85	Reamers, Tapered	21.84	38
102	Spot Welding Gun, Resistance	21.84	38
110	Steam Cleaner	21.84	38
82	Radiator Pressure Tester	20.69	36
83	Reamers, Adjustable	17.82	31

EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION	PERCENTAGE OF MEMBERS USING	NUMBER OF MEMBERS USING
54	Jacks, Twin Saddle	17.24	30
8	Aligning Machine, Front-End	13.79	24
84	Reamers, Special	13.22	23
59	Mallet, Leather	11.49	20
10	Arbor Press	5.17	9

Total Respondents 174

APPENDIX D
BIBLIOGRAPHY

References*

1. Florida Writing Team.

2. Tait, Deroche, and Hildebrand. **The Principles of Auto Body Repairing and Repainting.** Prentice-Hall, 1971.

3. **Motors Crash Estimating Guide,** Blackhawk Manufacturing Company. Truway specifications.

4. **Automotive Refinishing Principles and Techniques,** Dupont Company.

---

*V-TECS Catalog, Appendix A

State-of-the-Art Literature*

The state-of-the-art report provided conclusive evidence that little has been done in the auto body repair field to develop performance-based instruction. For this reason the Florida State Department of Education chose the auto body repair field as a top priority to develop performanced-based objectives for this skill.

The following Bibliography of Research provides the user of this catalog with a comprehensive list of the material used in this research. Much of the material was helpful; however, the personal interviews with the incumbent workers and supervisors provided the best information on duties and tasks actually performed in day to day work.

Bibliography of Research

Alabama, University of. **Automobile Body and Fender Repair and Refinishing, A Study Guide and Progression Record in Automobile Body and Fender Repair and Refinishing.** Trade and Industrial Education, Montgomery, Alabama. February 1966.

Alabama, University of. **Automobile Body and Fender Repair and Refinishing, Job Tests.** Trade and Industrial Education, Montgomery, Alabama. March 1966.

Briggs, L. J. **Handbook of Procedures for the Design of Instruction.** American Institute for Research: Pittsburg, Pennsylvania.

Briggs, L. J., and Gagne, R. M. **Principles of Instructional Design.** New York: Holt, Rinehart, and Winston. 1974, in press.

California State Department of Education. **Automobile Body Repair, Workbook.** Bureau of Industrial Education, DOE, Sacramento, California. 1970.

Colucci, Leonard. **Auto Body Refinishing.** Camden County Vocational and Technical Schools, New Jersey State Department of Education and Rutgers University. June 1970.

Consumer Reports, "Basic Body Dimensions of 1973," Vol. 38, pp. 247-49. April, 1973.

Dade County Public Schools. **Automotive Body Repair and Refinishing — Course Outline.** Lindsey Hopkins Education Center, Miami, Florida. January 18, 1966.

Department of the Army. **Military Occupational Data Bank Questionnaire.** U. S. Army Military Personnel Center, Military Occupational Research Division, Alexandria, Virginia. 1973.

---

*V-TECS Catalog, Appendix C

Department of the Air Force. **Instructional System Development.** Air Training Command, Air Force Manaul 50-2, Washington, D.C. December 31, 1970.

Department of the Air Force. **Instructional Programmer.** Lackland Air Force Base, Texas. January 1971.

Department of the Air Force. **United States Air Force Job Inventory** (Vehicle Maintenance Career Field). Occupational Survey Branch, Lackland Air Force Base, Texas. June 15, 1972.

Department of the Air Force. **Instructional Systems Development (ISD) Course** (Programmed Text). Air Training Command, Lacklad Air Force Base, Texas. March 7, 1972.

Department of the Air Force. **Handbook of Designers of Instructional Systems.** Air Training Command, AF Phamphlet 50-58, Washington, D.C. July 1973.

Department of the Air Force. **Principles and Techniques of Instruction,** Air Training Command, Air Force Manual 50-9, Washington, D.C. April 3, 1967.

Department of the Air Force. **Programmed Learning.** Air Training Command, Air Force Manual 50-1, Washington, D.C. January 13, 1967.

Duval County Public Schools. **Automotive Body Repair and Refinishing** (A two-year course outline). Industrial and Technical Education Section, Jacksonville, Florida. 1965.

Educational Testing Service. "Competency Tests Help Tradesmen Earn Academic Credit" **ETS Developments**, Vol. 20, No. 4. Fall 1973.

Florida Department of Commerce. **Florida Employment Directions Industries and Occupations, 1968-1975.** Division of Administration, Office of Research and Planning. November, 1970.

Florida Department of Commerce. **Florida Manufacturing Employment Estimates by Industry and Occupation.** 1971.

Gagne, R. M. **The Conditions of Learning.** 2nd ed. New York: Holt, Rinehart, and Winston, 1962.

Hullin, Leroy T. **Exploratory Drafting -- Auto Body Repair.** Vocational-Technical Curriculum Laboratory, Rutgers University, New Brunswick, New Jersey. July 1971.

Idaho State Board of Vocational Education. **Auto Body Repair and Painting Program.** Division of Trade and Industrial Education, Boise, Idaho. 1973.

Independent Garage Owners of America, Inc. **Apprenticeship and Training Standards for Automobile Mechanic, Body Repairman and Painter.** Manpower Administration, Department of Labor, Washington, D.C. 1966.

Johnson, Milo P. **Multimedia System of Individualized Instruction.** Mt. San Jacinto College, Gilman Hot Springs, California. 1972.

Loudermilk, Kenneth M. **Follow-Up Study of Vocational Students at North Idaho Junior College.** Idaho Occupational Research Unit, Moscow, Idaho. July 1967.

McDonough, Frances S. **Guide for Course of Study for Auto Body Repairman.** Tennessee State Board for Vocational Education, Nashville. Tennessee. 1968.

Melching, William H., and Borcher, Sidney D. **Procedures for Constructing and Using Task Inventories.** Ohio State University, Center for Vocational and Technical Education, Columbus, Ohio. March 1973.

Milwaukee Public Schools, Wisconsin Division of Curriculum and Instruction. **Auto Body Repair: Tentative.** Milwaukee Public Schools, Wisconsin Division of Curriculum and Instruction. 1966.

Mississippi State Department of Vocational Education. **A Basic Plan for the Organizationa and Management of Instruction in Vocational Automobile Body Repair.** Mississippi State College, Mississippi. 1968.

Netrick, Leroy M. **Guidelines for Developing Job Inventory Task Booklets.** Southern Association of Colleges and Schools, Vocational-Technical Education Consortium of States, Atlanta, Georgia. January 1974.

New York State Education Department, Bureau of Continuing Education Curriculum Services. **Auto Damage Correction Occupations: A Suggested Outline of Service and Levels for the Automotive Industries Occupations.** Albany, New York. 1969.

Office of Education, Department of Health, Education and Welfare, Washington, D.C. **Automotive Body Repairman: A Suggested Guide for a Training Course.** 1968.

Ohio State Department of Education. **Suggested Guidelines for Developing a High School Trade and Industrial Program in Automotive Body and Fender Repair.** Trade and Industrial Education, Columbus, Ohio. 1967.

Ohio State Department of Education. **Auto Body and Fender Repair: Suggested Course Outline.** Trade and Industrial Education, Columbus, Ohio. January, 1969.

Ohio State University. **Review and Analysis of Instructional Performance Objectives in Vocational Education Curriculum.** ERIC Clearinghouse on Vocational and Technical Education, The Center for Vocational and Technical Education, Columbus, Ohio. 1973.

Oregon State Board of Education, Division of Community Colleges and Career Education. **Curriculum Guide for Metals.** Salem, Oregon. September 1969.

Radvany, John E. **Auto Body Repair, I.** New Jersey State Department of Education, Rutgers University, New Brunswick, New Jersey. June 1962.

Roney, Maurice W. **Automotive Body Repairman, Suggested Guide for a Training Course.** Office of Education, Washington, D.C. 1965.

South Carolina State Department of Education. **Automobile Body and Fender Repair Curriculum Guide.** Office of Vocational Education, Columbia, South Carolina.

Tait, A; Deroche, A. G.; and Hildebrand, N. N. **The Principles of Autobody Repairing and Repainting.** Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1971.

Texas A&M University. **Auto Body Repair and Painting: Suggested Basic Course Outline.** College Station, Texas. July 1964.

Texas, University of. **Auto Body and Fender Repairman.** Division of Industrial Education, Austin, Texas. January 1967.

Toboldt, Bill. **Auto Body Repairing and Repainting.** South Holland, Ill.: Goodheart-Willcox Co., Inc., 1972.

U. S. Department of Labor, Bureau of Labor Statistics. **Tomorrow's Manpower Needs.** Bulletin 1769. 1973.

West Virginia State Board of Education, Bureau of Vocationa, Technical and Adult Education. **Auto Body Repair (Teaching Outline).** Charleston, West Virginia. 1970.

Additional bibliography suggested by South Carolina Auto Body Repair V-TECS Teacher Committee.*

Auto Body Curriculum Guide. Stillwater, Oklahoma: State Department of Vocational and Technical Education.

Auto Body and Fender Repair Curriculum Guide. Project #72-7010. Columbia, South Carolina: State Department of Education, Office of Vocational Education, 1973

Auto Body Repair: A Multimedia Instructional Program. Costa Mesa, California: Teaching Aids, Inc.

Hobson, W. T., ed. **Automotive Refinishing — Principles and Techniques.** Dupont Refinishers News.

Motor Crash Estimating Guide.

Rhone, L. C. **Total Body Repair.**

VICA. **U.S. Skills Olympics for Auto Body Repair.** Falls Church, Virginia, 1975.

*This Committee sequenced the catalog.

Subject Matter References Used in Other V-TECS States

All states in the consortium were surveyed. The following information reflects the results of the survey.

Alabama

Total Auto Body Repair, Howard K. Sams Publishing Co.
Auto Body Repair (Performance-Based Instruction) for students
Auto Body Repair (Performance-Based Instruction) for teachers

Florida

No references

Georgia

Auto Body Curriculum Guide, Post-Secondary, Georgia Department of Education, Atlanta, Georgia.
Auto Body Curriculum Guide, Secondary, Georgia Department of Education, Atlanta, Georgia.

Illinois

No response

Kentucky

No response

Maryland

No response

Oklahoma

Oklahoma Auto Body Curriculum Guide

Pennsylvania

No response

Virginia

No response

West Virginia

West Virginia Auto Body Curriculum Guide

Bibliography

Advanced Collision Repair -- Unibody Crash Correction and Underbody Alignments for Unibody Cars (Technician's Reference and Work Guide). Detroit: General Motors Corp./Fisher Body.

Application Guide for Automotive Adhesives, Coatings, Sealers. St. Paul, Minnesota: Automotive Trades Division/3M, 1982.

Automotive Refinishing Principles and Techniques. Wilmington, Delaware: E.I. duPont de Nemours and Co., Inc., 1981.

Blackhawk Company Training Manual. Jessup, Maryland: Applied Power, Inc., 1982.

Bottom View Auto Body and Frame, Dimension Charts. Lansing, Michigan: Tru-Way Company, 1983.

Crouse, William, and Anglin, Donald L. **Automotive Body Repair and Refinishing.** St. Louis: McGraw-Hill Book Company, 1980.

Duenk, Lester G.; Williams, W. Randolph; and Brooks, Clarence A. **Auto Body Repair.** Peoria, Illinois: Chas. A. Bennet Co., Inc., 1977.

Guy Chart: Complete Frame and Body Repair Equipment. Atlanta: Power Sales Company, 1976.

Mitchell's Collision Repair Manual. San Diego: Cordura Company/Mitchell Manuals, Inc., 1983.

Motor Crash Estimating Guide. New York: Hurst Corporation, 1983.

National Auto Dealers Used Car Guide (NADA). McClean, Virginia: NADA Used Car Company, published monthly.

Occupational Safety and Health Administration Rules and Regulations. Atlanta: U. S. Department of Labor, 1982.

Product Service Training Manual. Detroit: General Motors Corp./Fisher Body, 1982.

Rhone, L. C., and Yates, H. David. **Total Auto Body Repair**, 2nd ed. Indianapolis: Bobbs-Merrill Educational Publishing, 1983.

Straighten It the Simple Way — Kar Grabber: Operating Manual. Brunswick, Georgia: Grabber Manufacturing Company, Inc., 1982.

Thomas, D. W. **Making Better Plastic Welds.** Lyndonville, Vermont: Laramy Products Co., Inc., 1981.

Toldboldt, Bill. **Autobody Repair and Refinishing.** South Holland, Illinois: Goodheart-Wilcox Publishing Co., 1979.

Audio-Visuals

Blackhawk Collision Repair, 2861 Jessup Road, Jessup, Maryland 20794.
"New Science Unibody Repair" (slide presentation)

General Motors Corporation, GM Building, Detroit, Michigan 48202.
"Up From Clay" (16mm film, 45 minutes)

"A B C of Hand Tools" (film)

Modern Talking Picture Service, Dept. V.W., 1212 Avenue of the Americas, New York 10036.
"Auto Body Repair" (filmstrip)

"The Car Makers" (film)

Prentice-Hall Media Inc., 150 White Plains Road, Tarrytown, New York 10591.
"Using Body Jacks and Frame Machine" (filmstrip)

"Auto Body Construction" (filmstrip with cassette)

"Sanding Techniques, Tools and Materials" (filmstrip No. 941-21)

"Masking, Priming and Puttying" (filmstrip No. 941-23)

"Surface Prep for Painting" (filmstrip No. 941-22)

"Spraying Color on Vehicle" (filmstrip No. 941-24)

"Compounding and Polish" (filmstrip No. 941-26)

Sterling Films, 390 West Jackson Blvd., Chicago, Ill. 60606.
"The Art of Safety" (film)